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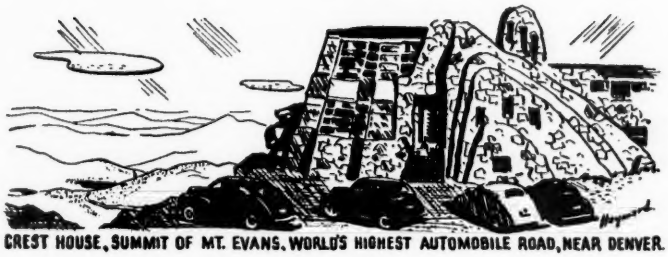

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DENVER, COLORADO, JULY 15–JULY 18, 1942

CONVENTION NUMBER

SPECIAL NEUROSURGERY ISSUE

J. Rudolph Jaeger, Guest Editor

VOLUME V

May-June 1942

NUMBER 3

Official Journal of The International College of Surgeons Published Bimonthly

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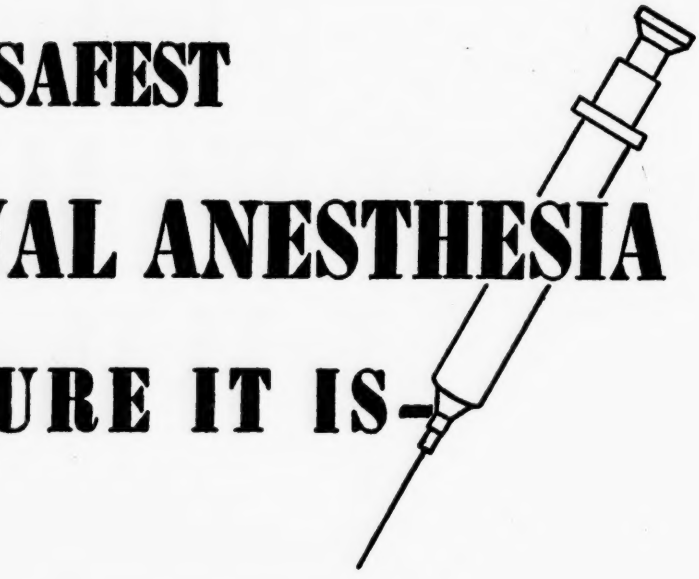

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The Journal of the
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Volume V MAY-JUNE 1942 *Number* 3

Editorial

Neurosurgery

THIS Neurosurgical issue of the Journal of the International College of Surgeons is in recognition of the fact, by the surgical profession, that neurosurgery is an established specialty and is accepted as such by the bulk of the medical profession. While admittedly this specialty is still very much in its infancy, yet the splendid results obtained by those even as yet poorly trained but giving their full time and attention to it, attests to the importance of the individual surgeon giving his full concern to a complicated, highly specialized, surgical field. The general surgeons deserve full recognition for their part in pointing the way for those to follow in the many pertinent, careful observations they have taught and recorded which had a direct bearing on the development of this specialty. Without the early stimulating teaching and writings of the general surgeons, Keen, Horsley, Krause, de Martel, and many others, neurosurgery as a specialty would still be only an immature idea. Indeed, many of our most noted and skilled surgeons holding high places in our leading teaching institutions gave up the practice of general surgery to give full time to the study and teaching of neurosurgery. Our most notable ex-

amples were the late Charles Harrison Frazier at the University of Pennsylvania and Harvey Cushing at Johns Hopkins University, later at Harvard.

It is quite noticeable among the general surgeons that those most skilled have the wisdom not to be enticed into attempting operations in this most complicated specialty. Surgical skill alone is not enough for success; the diagnosis must also be made by the surgeon and this means that the surgeon must be a neurologist—at least to the point of being well trained in surgical neurology. It must be admitted that a thorough training in general surgery is by far the best background for the training of the neurosurgeon and the present prevailing method of a two or three years' neurosurgical training of an interne, then turning him out as a full-fledged specialist entirely on his own responsibility, is open to question in developing real skill in neurosurgery.

The neurosurgeon is egotistical enough to believe and hope that he has added to the knowledge of the surgical profession to an extent far beyond the proportion of the actual number of specialists in this line. Witness the freedom from sepsis, shock, anesthetics, and deaths in neurosurgical operations requiring several hours to perform—many of them on relatively poor operative risks. Also the reduction of operating time for craniotomy for brain tumor from an ordeal which formerly required from five to twelve hours which now is commonly consummated in from two to three hours.

Neurosurgery still admits that neurosurgical knowledge and technique has little more than just started, but it sincerely believes that with the united efforts of our disciples, consecrated to the highest ideals of our medical profession, that it will still progress as an invaluable adjunct to the healing art. The opportunities for untiring energy and thought are unlimited in neurosurgery. The rewards may be few and infrequent, but brave hearts will find them tasty morsels, palatable in proportion to the honest toil expended.

The neurosurgical horizon, to be sure, will never be reached although, as we look hopefully forward, it seems just ahead. Nevertheless, it can be said that neurosurgery at the present time is well on its way—hand in hand with the many other specialties in our great common crusade against pain and illness.

J. Rudolph Jaeger.

HOTEL RESERVATIONS FOR DENVER MEETING

In view of the great demand for reservations for the Denver Assembly, July 15-July 18, please make your reservations *promptly. Address:* Dr. Dean W. Hodges, Republic Building, Denver, Colorado.

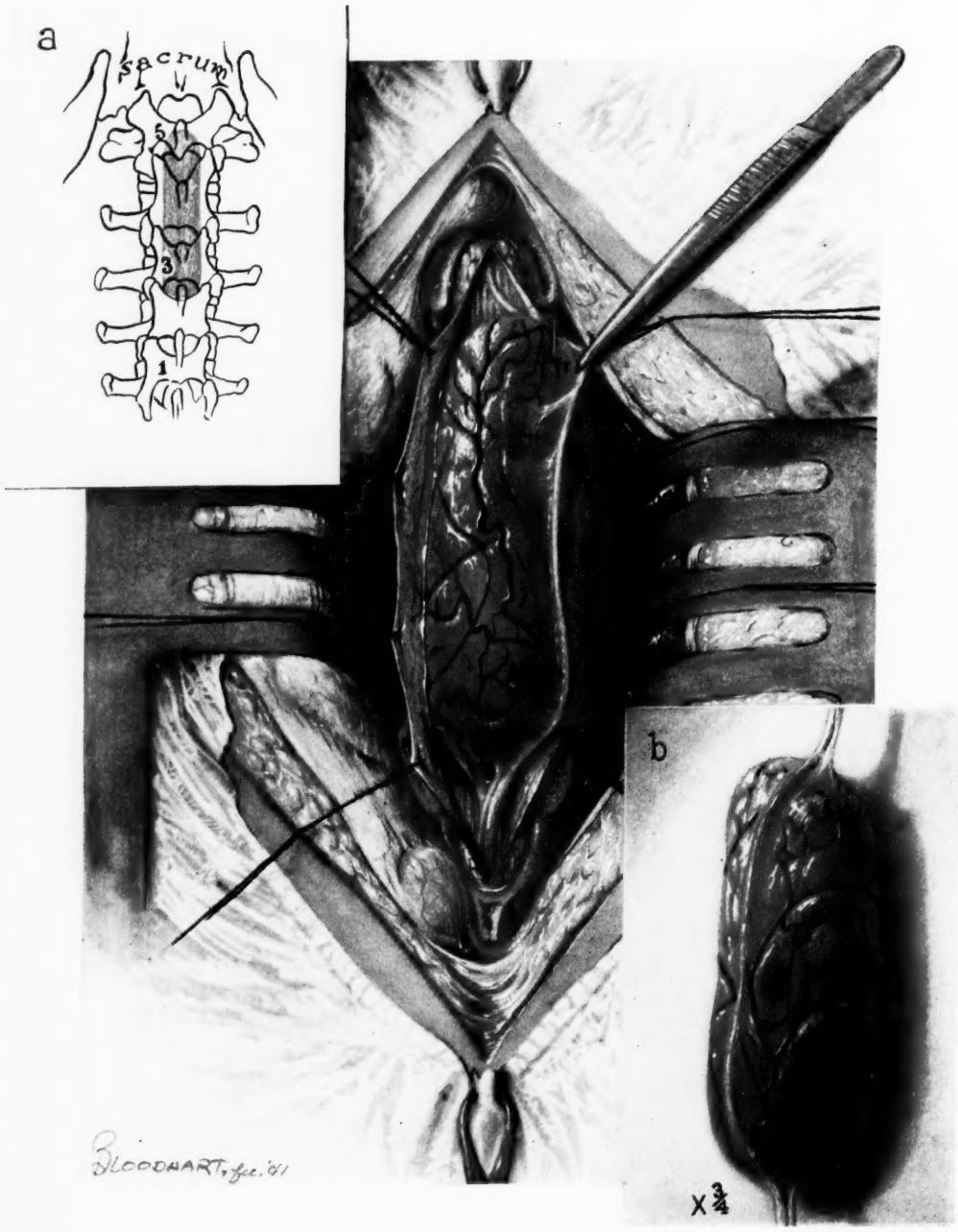

Fig. 1. Tumor as it appeared at the time of operation showing sensory division of the nerve root coursing over the tumor. Insert (a) approximate location of tumor in the spinal canal. Insert (b) sensory division of the nerve root as it was found to course around the side of the tumor, and the motor division that appeared to develop into a fusiform enlargement constituting the tumor.

Surgical Lesions about the Spinal Canal and the Significance of the Character of Pain in Differential Diagnosis and Localization*

RUPERT B. RANEY, M.D.
LOS ANGELES, CALIFORNIA

WHEN space-occupying lesions in or about the spinal canal enlarge sufficiently, they will eventually come to involve one or more spinal roots. If such lesions, e.g., neoplasms, posterior herniations of the *nucleus pulposus,* etc., first involve a spinal root, the earliest symptom is usually an irritative one, and consists mainly of pain. On the other hand, if these lesions have their origin within or adjacent to the spinal cord, they may for a short time give signs of involvement of the spinal pathways, then pain may not be the initial symptom. However, it usually appears early; certainly long before subarachnoid block and profound cord changes take place.

The early recognition of these lesions is of importance since they usually lend themselves to successful surgical treatment. Of further importance, early recognition and operative interference preclude prolonged preoperative disability, and postoperative morbidity. Conversely, if these lesions are allowed to progress to extensive sensory changes and paralysis, recovery is usually prolonged and often incomplete.

The early signs of space-occupying lesions, which impinge directly upon the spinal cord or arise within its substance, depend largely on the part of the cord first affected. Dorsally situated lesions, such as the frequently encountered meningioma, might early give rise to minor disturbances of proprioception, but ordinarily of such quality that the patient either would not recognize the disability or would ignore the defect. As the lesion expands, traction or pressure on one or more spinal roots soon takes place, certainly long before symptoms of a complete transverse lesion manifest themselves. Thus, as a rule, pain comes on months or even years before extensive cord damage occurs.

If pressure on the cord is exerted by laterally situated lesions, a partial Brown-Séquard syndrome could reasonably become a part of the clinical picture. Here again pain would most certainly make an early appearance, since laterally located lesions would quickly come to involve one or more spinal roots. It, therefore, becomes clear that the early manifestations of space-occupying lesions about the spinal canal depend largely on the part of the spinal cord which first becomes affected, and pain is almost universally the earliest complaint.

In order to arrive at an early diagnosis during the state of pain, and before the onset of profound cord changes, a careful study of the character of the pain is most essential. Although pain is a common complaint of almost all diseases, it differs greatly in its character, intensity and distribution; and is inclined to show certain characteristic features which tend to identify the underlying disease process. An excellent analysis has been made of the various types of pain encountered in abdominal

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disease. Today every physician is familiar with the characteristics of pain encountered in appendicitis, renal calculus, cholelithiasis, etc. Actually, a careful history of the pain and associated symptoms in abdominal disease will give sufficient evidence to establish an early diagnosis in a high percentage of the cases. On the other hand, pain which emanates from disease affecting the spinal axis has received considerably less attention on the part of the general medical profession than the pain associated with other diseases. Thus, disease about the spinal canal is often not recognized until late, and after the onset of profound cord changes.

The pain which accompanies these lesions has in the majority of cases certain definite labelling characteristics: (1) it is usually severe and gripping in character, (2) it invariably follows the anatomic distribution of the spinal root or roots which are affected, (3) it does not radiate into adjacent areas which are not supplied by the affected nerve root, (4) it is often exaggerated by coughing, sneezing, straining or other factors which tend to place the affected root on tension or under abnormal pressure. Thus, the segmental distribution of pain, its character, and the factors which influence it, serve sharply to differentiate it from the pain which emanates from lesions elsewhere in the body, such as the vague referred pain from visceral disease, the pain complained of by those suffering from functional disorders, etc.

In visceral disease the pain is as a rule deep seated and located in the general vicinity of the involved viscus, and the referred pain appears in a minor role and in the body segment from which the viscus had its origin. Pain from regional somatic disease, such as diseases of the sacroiliac joint, is generally local in character and is accompanied by local tenderness; furthermore, it does not show segmental distribution. In functional disorders the pain tends to transgress anatomic limitations, and is often associated with anesthesia of the "glove" or "stocking" type. On the other hand, the true signs of spinal space-occupying lesions may be overlooked or actually obscured by functional elements in susceptible people. This occurs more often following long-standing pain in patients who have gained the impression that they are suspected of complaining unnecessarily.

Space-occupying lesions which most commonly affect the spinal roots fall into four general groups: (1) posterior herniations of the *nucleus pulposus,* (2) neoplasms, (3) infectious granulomata, and (4) suppurative infectious diseases. Patients having neoplasms as a rule seek medical aid early in their course because of pain. The first manifestation of pain is usually that which emanates from a single spinal root. Since neoplasms progressively expand, other roots later become affected, and finally profound cord changes occur; unfortunately, this late stage is too often reached before the diagnosis is made.

Posterior herniations of the *nucleus pulposus,* in contrast to spinal tumors, as a rule do not progressively enlarge; rarely do more than one or two roots become affected, and profound cord changes are the exception. The pain, while similar to the pain in spinal tumors, tends to show exacerbations and remissions. The attacks come on rather suddenly; they are usually associated with some unusual but minor stress to the back, and continue for weeks at a time. In many cases the pain eventually becomes intractable in spite of good management; then neurosurgery offers the only solution to the problem. In the writer's experience these lesions have been found most frequently in the lumbar region, although they do occur else-

where. Attention has been called to this fact by Love (1939),[1] Love and Walsh (1940),[2] Spurling and Grantham (1940),[3] Bradford and Spurling (1941),[4] Dandy (1941),[5] and others. These lesions, when in the lumbar region, produce the pure clinical type of radicular pain which is often referred to as "sciatica." Therefore, the pain from such lesions should not be confused with the pain referred to the lower extremities from other diseases; such as, prostatic disease, tubo-ovarian disease, arthritis, etc., as is often the case. The pain in the latter conditions is not segmental in distribution; furthermore, it differs in other characteristics.

Granulomata behave very much after the fashion of the neoplasms; however, they can usually be recognized by other laboratory labelling characteristics. In suppurative infections the progress of symptoms is much more rapid. Sensory loss rapidly follows motor paralysis, and there is generally other evidence of infection, such as fever, leucocytosis, etc.

When a single spinal root ceases to function as a result of compression by a space-occupying lesion, the alteration of function does not differ from that pointed out by Head (1894),[6] Sherrington (1898),[7] Foerster (1936),[8] and others, i.e., anesthesia does not occur. Actually, there is rarely more than diminution of pain and temperature sensibility in the affected dermatome; other sensory perceptions such as of touch, pressure, vibration, etc., are relatively normal.[9] Furthermore, the tendon reflexes of the muscles supplied by the spinal root may be only slightly diminished since the skeletal muscles are supplied by more than one spinal root. Thus, it becomes clear that space-occupying lesions about the spinal canal, early in their course give rise mainly to a characteristic type of pain. Furthermore, very few objective findings are present. On the other hand, these lesions can be recognized early in a high percentage of cases by a careful analysis of the character, quality and distribution of the pain alone.

In the cauda equina, because of the amount of space, lesions may vary greatly in size depending on their location, yet give rise to very few signs except pain. For example, neoplasms may attain a large size yet give rise to no more signs than the much smaller and laterally situated posterior herniations of the *nucleus pulposus*.

Since the character, quality and distribution of pain is the most important single factor leading to the diagnosis of spinal space-occupying lesions, the following somewhat unusual cases are reported.

REPORT OF CASES

Case 1: Large tumor of the cauda equina with unilateral "sciatica." Diminished right Achilles' reflex, and slight diminution of pain perception on the outer aspect of the right foot.

The patient, a man of 38 years, was admitted to the hospital, January 16, 1939, because of severe pain radiating into the right leg. Five months before, following a minor back strain, the patient had first experienced pain in the low back region. After a few days the pain began to radiate down the posterior aspect of the right leg onto the lateral surface of the foot, and into the little toe. The pain persisted for about six weeks when it suddenly disappeared. After a few days it re-appeared suddenly, and was of the same character and distribution as during the previous attack. Coughing, sneezing, straining at stool, etc., increased the intensity of the pain; actually, the second attack came on suddenly during a violent paroxysm of coughing. According to the patient's description the pain followed a very definite pattern downward on the posterior aspect of the thigh into the leg, heel and lateral surface of the foot and small toe; it did not extend around to the anterior, middle or lateral surfaces of the thigh. There was no history of disturbance of bladder or rectal function. The remainder of the history was essentially unimportant.

Examination showed the patient to be well developed and well nourished. The blood pressure was 120 systolic and 80 diastolic; the pulse averaged 80 beats per minute, and the temperature was 98.2° Fahrenheit. The neurologic and general examinations gave normal findings except for the lower extremities. The right Achilles' tendon reflex was diminished. There was a slight impairment of pain perception over the outer aspect of the ankle, foot and little toe. Temperature sense in this same area was also slightly diminished; other modalities of sensation were normal. Lumbar puncture at the fifth interspace gave clear spinal fluid; Queckenstedt's test gave normal findings; there were two cells; total protein 100 mg.;

sugar 70 mg.; the Wassermann reaction was negative, and the colloidal gold curve was normal. Roentgenographic studies showed almost a complete obstruction to lipiodol extending from the second lumbar vertebra downward to the fifth lumbar vertebra; however, the obstruction was not complete as evidenced by the fact that part of the lipiodol passed from below to above the lesion.

At operation, January 21, 1939, a large tumor was removed (see fig. 1) measuring 7x1.8x1.9 cm. The tumor actually consisted of an enlargement of one of the roots of the cauda equina (right first sacral), and microscopically had the appearance of a fibroblastoma. The postoperative convalescence was uneventful. The patient was discharged from the hospital on the tenth postoperative day, and returned to his employment as a carpenter on the forty-fifth postoperative day, and has remained well up to the present time.

COMMENT

The importance of pain in the early diagnosis of spinal lesions should here be re-emphasized. As pointed out in the history, pain alone brought this patient under observation. Furthermore, the character and quality of the pain and the factors which influenced it were consistent with those of spinal root origin, and directly led to the diagnosis. Because of the exacerbation and remission of pain in this case, and the history of trivial back injury, the patient was at first suspected of suffering from posterior herniation of the *nucleus pulposus*. On the other hand, because of a dry spinal tap at the fourth lumbar interspace, and not at the fifth lumbar interspace, a lesion larger than a posterior herniation of the *nucleus pulposus* was suspected, thus, lipiodol was introduced.

In spite of the large size which the tumor had attained, it had not as yet enlarged sufficiently to compress the surrounding roots of the cauda equina, and there was, therefore, only evidence of impaired function of the first sacral spinal root, i.e., slight impairment of pain- and temperature-perception in the first sacral dermatome and diminution of the right Achilles' tendon reflex. The appearance of the second attack of pain undoubtedly resulted from downward dislocation of the tumor, and resultant traction on the spinal root by increase of the intraspinal pressure from above downward at the time of the paroxysm of coughing. From the appearance of the specimen the question might be raised as to why Queckenstedt's test was not positive. This can be accounted for by the fact that the tumor, although large, had not yet completely obstructed the cerebrospinal fluid circulation. As long as there is patency in the subarachnoid space equal to, or larger than, the caliber of the lumbar puncture needle, both rise and fall of fluid in the spinal manometer will occur under compression, and release of compression, of the jugular veins.

Had this patient been allowed to wait until more advanced findings of tumor appeared, i.e., bilateral sciatica, paralysis of the extremities, extensive sensory loss, and disturbance of sphincter control, the preoperative disability and postoperative morbidity would have been materially prolonged. Furthermore, when such tumors are allowed to go on to more advanced stages they often leave permanent residual defects in both locomotion and sphincter control even after their removal.

When pain of radicular character and distribution appears and persists in spite of other diseases which are obvious, a thorough investigation of its cause should still be made. The following case further serves to emphasize the reliability of the quality, character and distribution of pain in, not only the diagnosis, but the differential diagnosis as well.

Case 2: Intractable pain radiating into the left leg for two years. Progressive muscular atrophy, upper right arm for two and one-half years. The only related neurologic finding to the "sciatica" was a diminished left Achilles' reflex. Roentgenographic studies showed the characteristic deformity of a posterior herniation of the nucleus pulposus. Operation gave complete relief from pain.

The patient, a boy of twenty years, was admitted to the hospital, November 8, 1938, because of persistent pain radiating from the left hip down the posterior aspect of the left leg for two years.

He stated that two years previously while playing

football, he received a back injury during practice. He stated that he had been "clipped from behind in the small of the back." For the following two weeks his back was stiff and painful, after which time he partially recovered, and was able to play football the remainder of the season.

About three months later, the stiffness in the back increased, and pain began to radiate down the posterior aspect of the left leg. He resorted to many kinds of treatment, but had been unable to obtain relief. On bending forward and then straightening up the pain was markedly intensified. Coughing and straining tended to intensify the pain. The sphincters had not been affected.

The remainder of the history was relatively unimportant, except that for the past two and a half years the patient had noticed a slowly developing weakness in the right hand, and had noticed that the right hand had become thinner than the left. He also noticed, especially about the palm of the hand (thenar and hypothenar eminences), fine fibrillary twitchings beneath the skin. Recently, during the previous two or three months, he had noticed these twitchings in the biceps, triceps, and deltoid muscles of the right arm. The past history, except for the usual childhood diseases, was not remarkable. The family history also gave no pertinent information.

Examination disclosed the patient to be exceptionally well developed and well nourished, weight 175 pounds. The blood pressure was 115 systolic and 80 diastolic; the pulse averaged 70 beats per minute, and the temperature was 98° Fahrenheit. There was atrophy of the interossei muscles of the right hand; the thenar and hypothenar eminences also showed considerable atrophy, and there was atrophy in the muscles of the forearm. The biceps and triceps muscles showed fine fibrillary twitchings, likewise, fine fibrillary twitchings were seen in the muscles about the shoulder girdle. The left arm and shoulder were not affected. No sensory changes in these areas were found and there was no pain complained of except in the low back and left leg. In the lower extremities there were no fibrillary twitchings or atrophy. The general impression was that the patient was suffering from progressive muscular atrophy involving the right arm, and that the sciatic pain was due to some other cause.

The tendon reflexes in the right arm were absent; in the left arm they were normal. The superficial reflexes were all present, and normal. The reflexes in the lower extremities were present and normal, except for the diminished left 'Achilles' tendon reflex. Sensory examination gave entirely normal findings. Lasègue's sign was positive on the left. Lumbar puncture gave clear spinal fluid. The Wassermann reaction was negative; cell count 2; total protein 35 mg.; sugar 60 mg.; colloidal gold curve was normal. Roentgenographic studies with lipiodol showed a rather sharp filling defect on the left side obliterating the dural sleeve of the left fifth lumbar root. The dural sleeve of the right fifth root and roots above and below filled normally (see fig. 2).

At operation, November 15, 1938, a posterolateral herniation of the *nucleus pulposus* was found on the left side (see fig. 2); the affected nerve root was identified as the fifth lumbar; it was compressed, swollen, and congested. The protruding portion of the *nucleus pulposus* was removed, and the sensory division of the affected nerve root was sectioned. Following operation there was complete relief from pain. On the tenth postoperative day the patient was

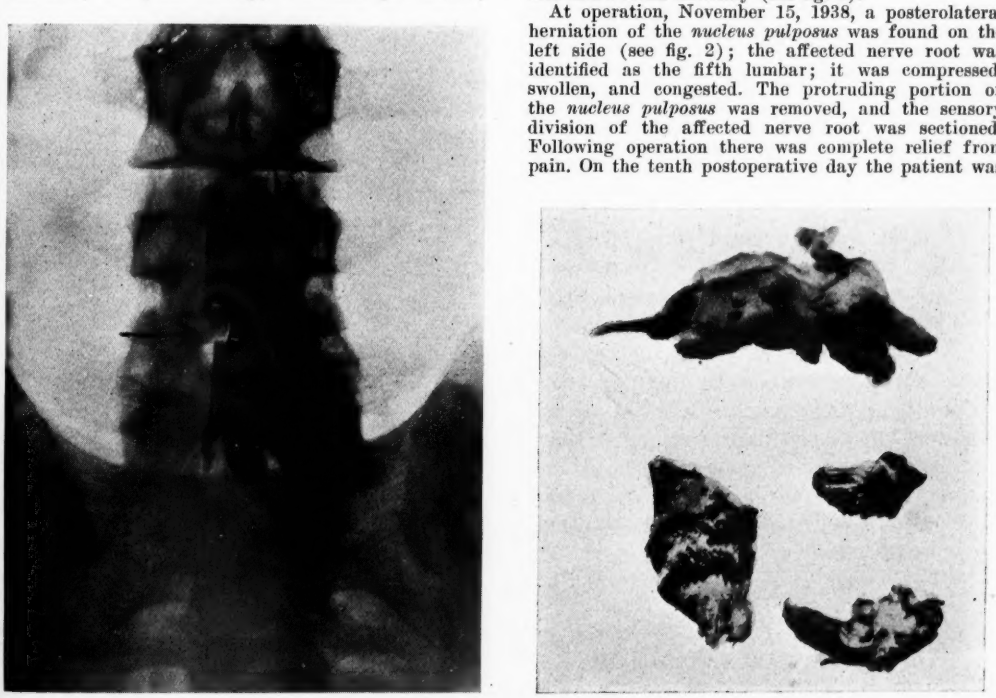

Fig. 2. Arrow indicates typical filling defect, demonstrated by roentgenographic lipiodol study, resulting from posterior herniation of the nucleus pulposus. Opposite are fragments of nucleus pulposus removed at operation.

discharged from the hospital. The following fall he returned to school, and in spite of the progressive muscular atrophy in the right arm played football the next two seasons. When last heard from, some three years after operation, he was still free from low back pain and "sciatica," and there had been only moderate increase in the symptoms of progressive muscular atrophy.

COMMENT

In the case of this patient the symptoms were very similar to the symptoms in the preceding one, i.e., the character and distribution of the pain and physical findings, yet there was a remarkable difference in the size and biologic nature of the two lesions. In the last patient, the true cause of sciatic pain could easily have been overlooked because of the co-existing and antedating evidence of disease of the nervous system. It should, therefore, be emphasized that progressive muscular atrophy does not, as a rule, cause a great amount of pain, and when pain does occur it does not stimulate the pain of spinal root compression. Since the "sciatic" pain in this patient had all the characteristics of a space-occupying spinal root lesion, it was not considered a part of the general picture of progressive muscular atrophy; thus, roentgenographic studies with lipiodol were done, and the final proof was obtained that two independent pathologic processes existed. Thereby it was possible to afford the patient relief from the "sciatica." Actually, surgery could well have been recommended in this case without the confirming lipiodol study because of the characteristic type of pain, its distribution, character, etc. Here, again, the character of the pain led to a diagnosis in spite of an obvious co-existing neurologic disorder.

SUMMARY

1. Space-occupying lesions in the vicinity of the spinal canal as a rule involve, at an early stage, one or more spinal roots, which give rise principally to pain.

2. The early recognition of these lesions is important from three points of view: (1) the preoperative disability can be minimized, (2) the postoperative morbidity reduced, and (3) residual impairment of function can be precluded.

3. Although certain physical findings, depending on the location of the lesion, may appear early, as a rule radicular pain is the first symptom that brings the patient to his physician.

4. The pain from space-occupying lesions about the spinal canal results from either traction or pressure of one or more spinal roots, and has certain definite labelling characteristics which distinguish it from the pain of diseases elsewhere in the body.

5. A careful analysis of the character of the pain will lead to an early diagnosis, treatment, and rapid recovery of the patient in the majority of cases.

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SUMARIO

1. Lesiones que ocupan espacio de la vecindad del canal espinal como regla envuelven, en un estado temprano, una o mas raices espinales, lo cual da lugar principalmente a dolor.

2. El reconocimiento temprano de estas lesiones es desde tres puntos de vista importantes: (1) la inhabilidad

preoperativa puede ser disminuida, (2) la mortalidad postoperatoria reducida, y (3) defectos residuales de función pueden ser preludiados.

3. Aunque ciertos hallazgos físicos, dependientes de la localización de la lesión, pueden aparecer temprano, como regla dolòres radiculares es el primer síntoma que trae el enfermo a su médico.

4. El dolor de lesiones que ocupan espacio alrededor del canal espinal resultan por tracción o presión de una o mas raices espinales, y tienen cierto sello caracteristico que las distingue de dolores por enfermedades en cualquiera otra parte del cuerpo.

5. Un analisis cuidadoso del caracter del dolor nos llevará a un diagnóstico temprano, tratamiento, y recobramiento rápido del enfermo en la mayoria de los casos.

RÉSUMÉ

1. Les lésions du canal vertebral généralement interessent un ou plusieurs rameaux des nerfs spinaux. Ces lésions sont accompagnées du symptôme douleur.

2. Il est important de reconnaître l'existence de ces lésions pour trois raisons: Afin de 1° diminuer la gêne et l'infirmité pré-opératoires. 2° diminuer, c'est-à-dire, de réduire le degré de morbidité post-opératoire. 3° de prévenir toute atteinte permanente de fonction.

3. Certains signes physiques dus au siège de la lésion existent au début. C'est la douleur radiculaire que porte le malade à consulter le médecin.

4. La douleur résultant des lesions occupant le canal vertébral est due à la traction ou à la compression exercées sur les rameaux spinaux. Cette douleur a des caractéristiques qui la distinguent du symptôme douleur qui accompagne les troubles d'autres parties du corps.

5. Une analyse minutieuse et soigneuse de la nature de cette douleur conduit à un diagnostic précoce, à un traitement approprié et à une guérison rapide dans la grande majorité des cas.

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Tic Douloureux

PARTIAL SECTIONS OF THE SENSORY ROOT OF VARYING EXTENT*

OLAN R. HYNDMAN, B.S., M.D.

A REPORT of my experience with tic douloureux was made in July 1938 in which the cerebellar approach to the sensory root of the fifth nerve was compared to the subtemporal approach from surgical and physiological standpoints.[1] The results obtained after partial sections of the sensory root appeared to be no different whether the root was cut just posterior to the Gasserian ganglion or near the pons. The sensory losses after partial sections were not in agreement with the proposition that each third of the sensory root corresponds with the respective peripheral branch distribution. If the lower half of the root is sectioned, the sensory losses are so mild they are hardly noticed by the patient until they are demonstrated objectively. As the root is cut from below upward the greatest sensory loss is first sustained on the ipselateral half of the tongue, the gums and buccal mucosa. The loss then progresses in the face in a manner that suggests a segmental or concentric arrangement with the mouth as the center rather than an arrangement corresponding to peripheral branch distribution.

The fact that a properly performed partial section of the sensory root will abolish the painful seizures of tic douloureux and yet invoke such minimal sensory losses in the face has advanced the surgical treatment of this pain syndrome to a point that leaves little to be desired. If so little as one-fourth of the upper fibers of the sensory root are spared, corneal sensation will be preserved. The dangers of corneal ulceration or the fitting of guards to protect an anaesthetic cornea should no longer be necessary.

When zones of almost complete sensory loss are sustained by either alcohol injection or root section, it is not uncommon for the patient to develop annoying paraesthesias in the anaesthetic zones. The mechanism of this indescribable sensation, which has been referred to as "Gasserian Ghosts," is not clearly understood. It is conceivable that it may be related to the sympathetic system. In any case the paraesthesia appears to be more prominent in anaesthetic zones and not so prominent in mild to moderately hypaesthetic zones. The paraesthesia appears to differ from marginal hyperaesthesia. The former is experienced by the patient in anaesthetic zones while the latter may be invoked by stimulating the marginal zone that separates the aesthetic from the anaesthetic zones.

Hence, the factors of subjective numbness and "Gasserian Ghosts" present the problem of determining the minimal section that will abolish the painful seizures. Toward this end I have been impressed by the important relationship that so called "trigger zones" bear to the painful seizures. These trigger zones are soon discovered by the patient and are almost always oral or perioral. Not uncommonly one is situated in the region of ala nasi. The most consistent statement given by patients is that eating, chewing, swallowing or talking will provoke the attacks. This suggests that the mouth itself is the chief locus of trigger zones. It is well known that if definite trigger zones are locally anaesthetized the painful seizures will be abolished as long as the anaesthesia

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lasts and the patient may eat a much needed meal in relative comfort.

These facts provide a possible explanation for the cure of tic douloureux after partial root section. The sensory losses are greatest in the oral and perioral regions and hence eliminate the trigger zones.

In May, 1941 I[2] reported a case of tic douloureux in which the pain was located only to the right forehead above the eyes. Chewing and talking iniated frequent attacks and the patient felt that stimulation of his gums on the right caused the attacks. The lower three-fourths of the sensory root were cut, causing a marked loss of sensibility in the right mouth and on the chin only. The patient has been completely free of painful seizures to the time of writing (19 months).

I thought it would be of value to make a systematic study of partial sections from maximal to minimal sections and the following six cases reveal the results of the studies thus far. The minimal section in this group consists of a section of the lower half of the root. I plan to continue the series by cutting less than half of the root because I feel that many patients can be cured in this way and thus be provided with as ideal a physiological result as is possible.

CASE REPORTS

In the following six cases an attempt was made to vary the degree of partial section in a systematic way and to correlate the result with the degree of section. The series progresses from a maximal partial section to one in which only the lower half of the root was cut. All exposures were made by the subtemporal route and all sections were made from below upward in the root. Taste was unimpaired after operation in all cases for salty, sweet, sour and bitter substances. Four of the six patients had had one or more alcohol injections previous to operation and the residual numbness from these procedures contaminated the results of the operation so far as sensory losses are concerned. Nevertheless they are instructive in some ways. Most patients have experienced alcohol injection before they come for operation.

All of the patients reported here, and in fact all the patients on whom I have operated for tic douloureux, developed herpes of varying extent about the mouth 2 or 3 days after operation.

In making the sensory examinations, light touch was tested with a wisp of cheese cloth, pain with a light prick of a pin, temperature with test-tubes containing warm and cool water and deep pressure by moderately pressing the end of an applicator stick on the skin. All these tests were made by comparing sensation with that on the normal side and usually with the patient's eyes closed. In the diagram showing

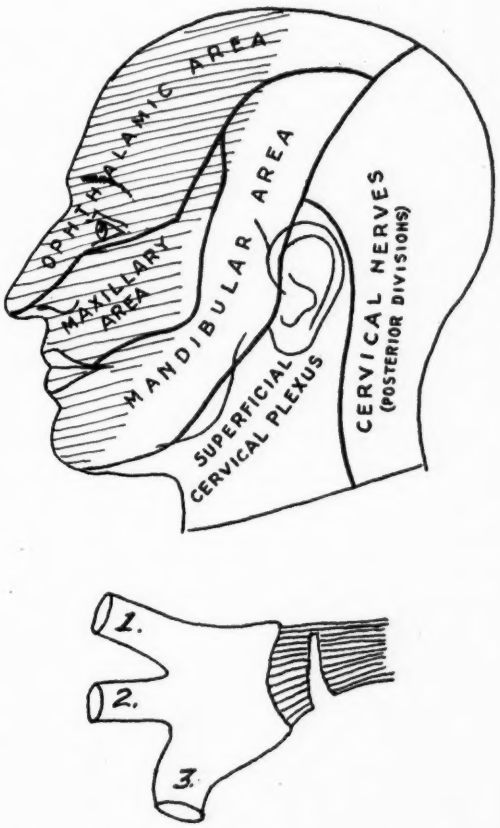

Fig. 1. Results of the examination of Case 1 ten months after operation. In the shaded zone as well as for left side of tongue, gums and buccal mucosa sensibility was as follows: light touch, O; pin prick, O; temperature discrimination, O; deep pressure, about 10 per cent of normal. Deep pressure was not completely lost at any locus. The unshaded zone was normal subjectively and to objective tests. The marginal zone was hyperaesthetic. Cornea on left retained only a trace of sensation to light touch. Motor function of fifth and seventh nerves unimpaired.

The insert is a diagrammatic representation of the extent of the partial section of the root.

the extent of partial section, the motor root of the nerve has purposely been omitted.

1. N.C., a white woman 54 years of age, described the symptoms of tic douloureux and located the pain anterior to the left ear. Five years ago she experienced tingling sensations in the tongue. Three years later the onset of one of these tingling sensations was followed immediately by an attack of sharp pain in the left face and thereafter the seizures were frequent. An alcohol injection gave relief for 4 months. Another injection gave relief to the present time. She knows only that the injections were made somewhere inside the mouth leaving a residual impairment of sensibilities on the left chin.

She described the excruciating pain as beginning in the left lower jaw and shooting over the entire left face to the top of the head. After the first alcohol injection the left side of the mouth (inside) was numb. When the pain returned, this numbness disappeared. She felt the left side of the tongue was a trigger zone. Eating, talking or jarring the head initiated the attacks.

Following the alcohol injection she developed a burning sensation on the left tongue and inside the mouth and on the left side of the lips which at times felt as if they were on fire. Substances such as mouth washes did not excite this paraesthesia but certain odors did, particularly that of ether.

Operation. On January 29, 1941, a maximal partial section of the sensory root of the fifth nerve was made on the left. Only a small filament was left intact in the upper aspect of the root. It would have been impossible to have cut more without making the section complete. See fig. 1.

Result. The following information was obtained at a check up examination 10 months after operation. She has been entirely free of painful seizures and is very pleased with the result. Subjectively she is conscious that the left side of the tongue and mouth is numb and describes a band of numbness on the left face which corresponds to that depicted in fig. 1. She stated, however, that she was hardly conscious of the numbness until she touched or rubbed the area or put food in the left side of the mouth. The burning sensation which developed in the left mouth and on the lips after alcohol injections was not changed by the operation, but after operation she has experienced "crawly, tingling, creepy and drawing" sensations in the anaesthetic zone on the left face. All of this, however, "bothers her very little" and is nothing to compare with the original painful seizures.

2. A.C., a white woman, 58 years of age. She described the symptoms of tic douloureux and located the pain to the region of the second division of the fifth nerve on the right. The painful seizures have become more frequent and severe for the past 3 years. She had discovered "trigger zones" on the right upper lip and right ala of the nose.

Operation. On February 5, 1941 a partial section of the sensory root of the fifth nerve was made on the right. About twice as many of the upper fibers were left intact as in case 1. It was estimated that about four-fifths of the fibers were cut from below upward. See fig. 2.

Result. The patient has been free of attacks to the time of writing (8 months). At a follow up examination on October 17, 1941 the patient stated that she was greatly pleased with the result. The numbness that she experienced was not a great bother. However, the gums, right side of the tongue and buccal side of the cheek felt dead and swollen and yet these parts and the right lower lip often burned and felt raw as if the skin were absent. Listerine burned these parts "like fire". She stated that if a fly or mosquito lit on the hypaesthetic areas of the face she experienced an unusual crawling sensation over the whole right face that was intolerable. The results of the sensory examination are given in fig. 2.

3. B. G., a white woman, 55 years of age. She described the symptoms of tic douloureux and located

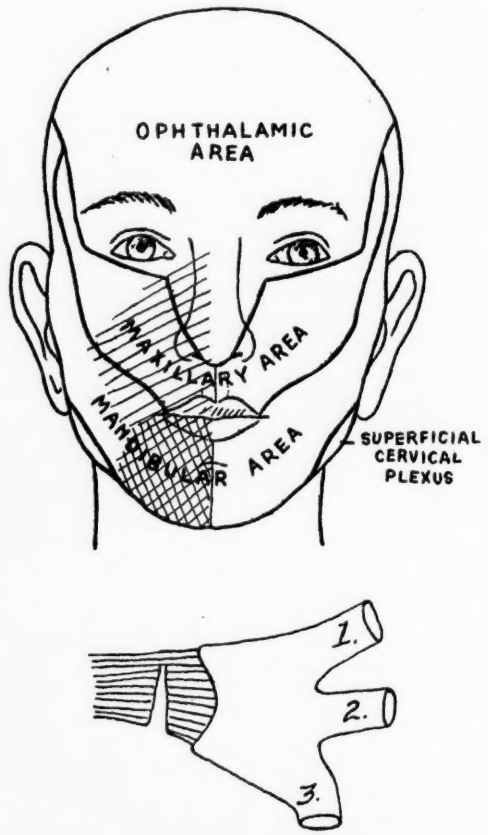

Fig. 2. Results of the examination of Case 2 eight and one-half months after operation. The right half of the tongue, gums, buccal mucosa and double hatched zone on the chin revealed sensibility as follows: light touch, O; pin prick, O; temperature discrimination, O; deep pressure, 25 per cent of normal. When pricking the chin she felt the pin point without pain. The single hatched zone was as follows: light touch, 50%; pin prick, 25%, temperature, 25%; deep pressure 75%. Corneal sensation on the right unimpaired. Motor function of right fifth and seventh nerves unimpaired.

The insert is a diagrammatic representation of the extent of the partial section of the root.

the pain to the left side of the nose and around the left eye. There were many seizures each day. They were initiated by eating and talking and washing the face.

Operation. On April 8, 1941 a partial section of the sensory root of the fifth nerve was made on the left. An attempt was made to duplicate the section made in case 2 and it was estimated that four-fifths of the fibers were cut from below upward. See fig. 3.

Result. The patient has been free of attacks to the time of writing (7 months). At a follow up examination on October 23, 1941 she stated that the only regions which seemed numb to her were the zone between the nose and left eye and the left eyelids themselves. She denied being conscious of numbness elsewhere on the face or in the mouth although she could not sense the presence of food in the left side of the mouth. The objective sensory losses are depicted in fig. 3. She described an electric-like prickling sensation almost constantly present and limited to the zone of objective numbness on the left check. She volunteered the statement that if a fly lights on this region an intolerable prickly sensation is initiated over the whole zone. This paresthesia is also initiated by brushing the hair in the ophthalmic region on the left but the sensation is limited to the zone of numbness on the left cheek. While the sensation is unpleasant, it is nothing to compare with the pain of tic douloureux.

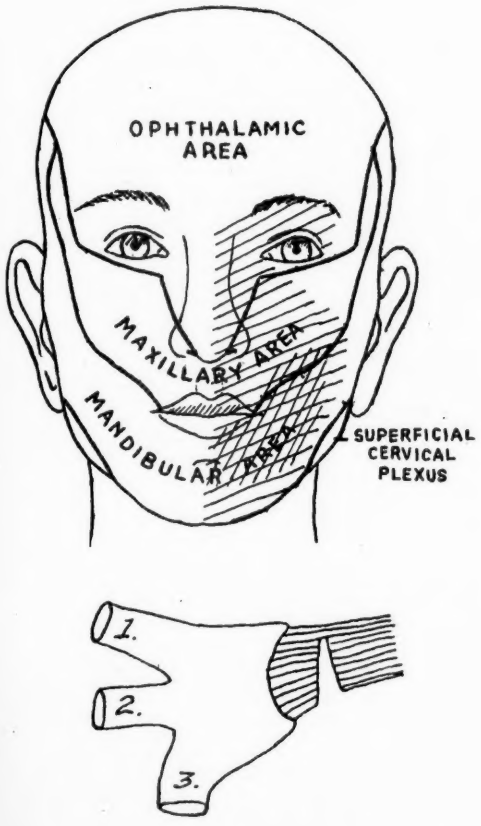

Fig. 3. Results of the examination of Case 3 six and one-half months after operation. The left half of the tongue, gums, buccal mucosa and double hatched zone revealed sensibilities as follows: light touch, O; pin prick, O. The single hatched zone: light touch, 50%; pin prick, O; temperature discrimination, O. Deep pressure was not completely lost at any locus. Corneal sensation on the left unimpaired. Motor function of the left fifth and seventh nerves unimpaired.

The insert is a diagrammatic representation of the extent of partial section of the root.

4. P.H., a white man 50 years of age, gave a typical description of the pain of tic douloureux which he located to the right side of the nose and right forehead. The tic began 10 years ago. He has had two or three injections of alcohol a year with relief each time for 3 to 4 months. The last injection of the second and third branches was done in May 1940 with relief for almost a year. For the past few months the attacks have occurred several times daily and also at night. Chewing, and also hot and cold food taken into the mouth, would initiate attacks. The residual sensory losses due to the alcohol injection are given in the legend to fig. 4.

When he brushed his closely cropped hair on the right he stated that he felt a peculiar crawling sensation under the right eye and on the right cheek. He was unable to describe it but denied that it was in any way painful.

Operation. On October 10, 1941 a partial section of the sensory root of the fifth nerve was made on the right. An attempt was made to cut the lower three-fourths of the root fibers. See fig. 4.

Result. The patient made an uneventful recovery and was highly pleased with the result. Chewing caused no semblance of the former attacks. The results of the examination are given in fig. 4. The chief sensory losses due to the operation occurred in the mouth and on the right chin and upper lip. The paraesthesia induced by brushing his hair was unchanged.

5. O.W., a white man 59 years of age described the symptoms of tic douloureux and located the pain as extending from the right angle of the mouth to the vertex of the head. The painful seizures began 3½ years ago. He soon observed that the right upper lip was a trigger zone so that touching or shaving this region initiated seizures. Chewing and talking also started the seizures. Three and one-half years ago he had an alcohol injection through the roof of the mouth which gave relief for 2 years. One year ago an injection below the right eye gave relief for 3 months and 3 months ago an injection above the eye gave no relief. Attacks occur daily.

In addition to the tic pain he describes a burning, crawling sensation, constantly present in the numb zone over the right lip and cheek. The right half of the tongue, gums and buccal mucosa are not numb.

Operation. On October 21, 1941 a partial section of the sensory root of the fifth nerve on the right was made. As near as could be estimated the lower five-eighths of the sensory fibers were cut—a little more than half but not quite three-fourths of the root. See fig. 5.

Result. The patient made an uneventful recovery and stimulation of the trigger zones no longer excites anything simulating the seizures. He states that his face feels only slightly more numb than before operation. The increased numbness is almost entirely in the mouth and on the right chin. The constant paresthesias are the same as before operation. The results of the examination are depicted in fig. 5.

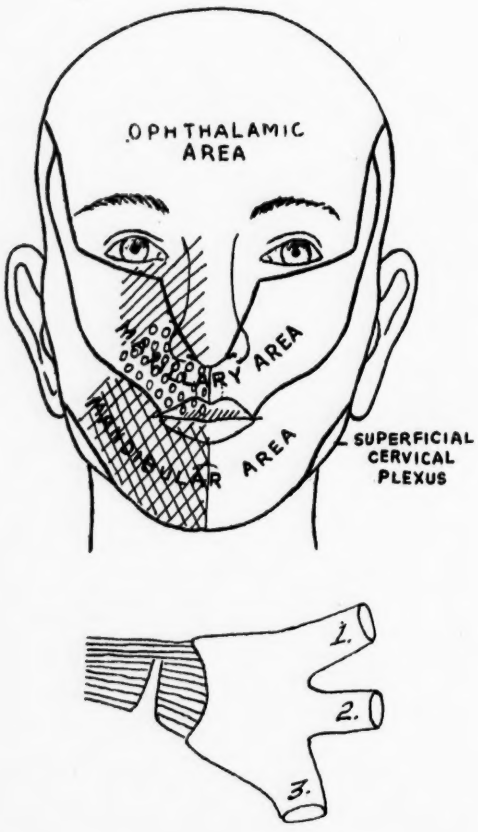

Fig. 4. Results of the examination of Case 4 twelve days after operation. (Before operation the sensory losses were as depicted here except for those on the chin which were very mild. The losses were also very mild, if any, inside the mouth). After operation the sensibilities were as follows: right half of tongue, gums, buccal mucosa and double hatched zone; light touch, O; pin prick, O; temperature discrimination, O. For the zone marked by circles these modalities were about 25% of normal and for the single hatched zone they were about 50% of normal. Deep pressure was not completely lost at any locus.

Corneal sensibility on the right unimpaired. Motor function of the fifth and seventh nerves unimpaired.

The insert is a diagrammatic representation of the extent of the partial section of the root.

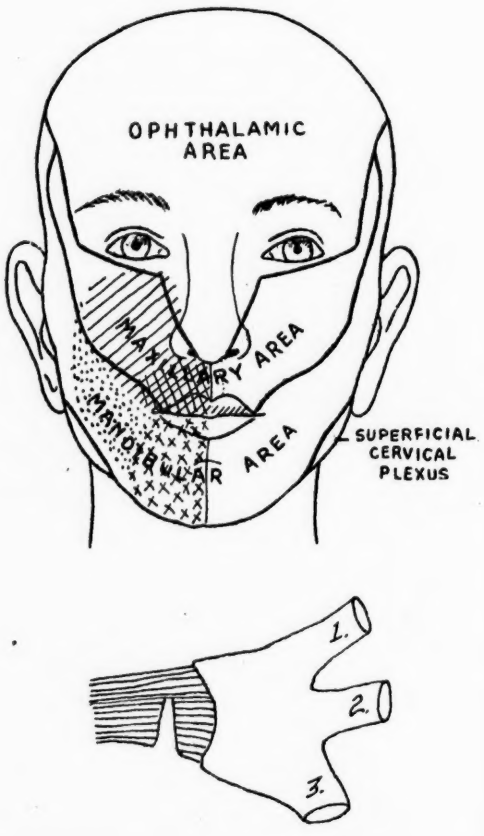

Fig. 5. Results of the examination of Case 5 eight days after operation. Sensibility to light touch, pin prick and temperature was lost on the right half of the tongue, gums, buccal mucosa and zone on chin marked by crosses. These modalities were about 50% of normal on the double hatched zone. In the single hatched zone touch was 90% with pin prick and temperature discrimination about 50%. The stippled zone represents an added margin in which pin prick only was about 50%.

Note. Much of this sensory loss was present before operation. The only additional loss due to the operation that could be detected was that in the mouth and that represented by crosses and the additional loss to pin prick represented by the stippled zone.

Corneal sensation unimpaired on the right. Motor function of the fifth and seventh nerves on the right unimpaired.

The insert is a diagrammatic representation of the extent of the partial section of the root.

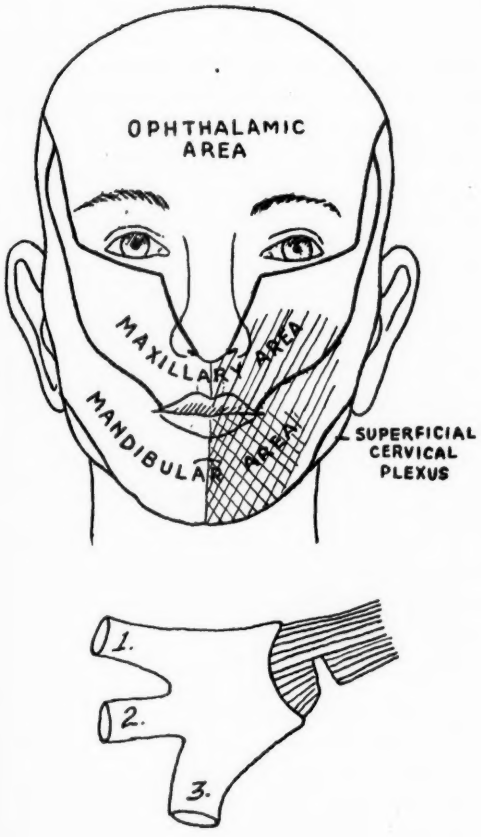

Fig. 6. Results of the examination of Case 6 eight days after operation. If one eliminates the region above the left upper lip, then the shaded zone represents the area of hypaesthesia before operation in which light touch and pin prick was about 50% of normal. Before operation the left side of the tongue, gums and buccal mucosa were not numb subjectively or to objective tests.

After operation the left half of the tongue, gums, buccal mucosa and double hatched zone represents sensibilities as follows: light touch, O; pin prick, O. Single hatched zone: light touch, 50%; pin prick, O. Temperature discrimination was impaired in this case in a much wider zone than other sensibilities. She could hardly discriminate heat on the left forehead and under the eye as well as on the hatched areas. She could discriminate cold only a little better than heat. Deep pressure was not lost in any locus.

Corneal sensation on the left unimpaired. Motor function of the fifth nerve on the left was impaired as before operation. Motor function of the seventh nerve unimpaired.

The insert is a diagrammatic representation of the extent of the partial section of the root.

6. C.J., a white woman 46 years of age describes the typical pain of tic douloureux in the left face. The attacks began 4 years ago. An alcohol injection at that time (second and third branches) gave relief for six months. Following this there were numerous injections, the last being one year ago. She now describes the pain as being located on the left face from chin to forehead. Many attacks occur daily. Chewing, talking, swallowing water, excitement and washing the face provoke the attacks. The residual hypaesthesia from the alcohol injections is given in

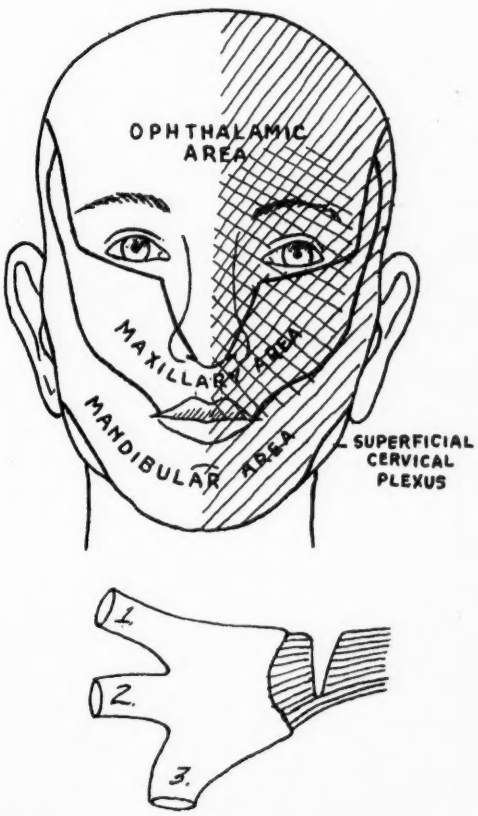

Fig. 7. Results of examination of G. E., a case of post-herpetic neuralgia. Sensibility in the single hatched zone was as follows: light touch, O to 10%; pin prick, O to 10%; temperature discrimination, O. In the double hatched zone: light touch, 50% preserved; pin prick, 50% preserved; temperature discrimination, O. Sensibility on left half of tongue, gums and buccal mucosa diminished little, if any. On another examination, sensation on the chin was recorded as, light touch, 75%, and pin prick, 0 to 20%.

Corneal sensation was 50% of normal on the left. The insert is a diagrammatic representation of the extent of partial section.

the legend to fig. 6. The motor function of the fifth nerve was impaired on the left.

Operation. On October 24, 1941 a partial section of the left sensory root was made. It was estimated that the lower half of the root was cut. See fig. 6.

Result. The patient made an uneventful recovery and lost all semblance of the former pain. Rubbing and washing the face, chewing and swallowing could be done with complete comfort. The results of the examination are given in fig. 6.

DISCUSSION

1. The nature of tic douloureux and the important role played by "trigger zones."

The results which I have obtained by controlled partial sections have strongly convinced me of the important relation of certain sensitive or "trigger" zones to the painful seizures, for it appears that sensibility of these zones must be intact in order to initiate the seizures. The trigger zones are predominantly oral and less often perioral. Hence movements of the mouth such as in chewing, swallowing and talking are almost uniformly given by the patient as initiating factors. The idea that the stomadeum is a necessary locus of these strange trigger zones correlates strikingly with the fact that the tic douloureux type of pain occurs no where else in the body other than in the distribution of the fifth and ninth cranial nerves. The importance of the trigger zones suggests, but not conclusively, that the basic or casual lesion of the syndrome is at their locus. The fact that tic douloureux is predominantly a unilateral syndrome greatly weakens this suggestion. The basic cause as well as the anatomical location of the lesion remains to be satisfactorily proved.

I have come to regard the syndrome of tic douloureux as one for which some pathologic physiology of the fifth nerve as a whole is responsible and to which the sensory integrity of the stomadeum is necessary. This point of view differs somewhat from the traditional one that implicates the peripheral branches of the fifth nerve separately. Most of my patients have described the pain in such a way as to indicate that it overlapped the distribution of the peripheral branches.

2. The pattern of sensory losses after partial section of the sensory root of the fifth nerve.

In this series of cases as well as in that previously reported[1] the results are not in keeping with the proposition that the thirds of the sensory root correspond with the respective peripheral branches of the fifth nerve. As the root is cut from the inferior fibers upward, the greatest sensory losses occur first in the mouth, and on the lips and chin on the same side. As the section progresses, the sensory losses progress not only from below upward but from the mid-sagittal plane lateralward. If only one-tenth to one-fifth of the superior fibers are left, a considerable zone of normal sensibility is retained on the entire face laterally as demonstrated particularly in case 1. The question immediately arises as to what the results would be if the roots were cut in such a way as to leave only a small bundle of the lower fibers. I have made such a partial section in only one case. The patient G.E. was reported in 1939.[3] He was a white man, 74 years of age, who complained severely of post-herpetic neuralgia in the left ophthalmic distribution. I made a partial section of the left sensory root of the fifth nerve in such a way as to leave about the lower one-fifth of its fibers. I stated in the previous publication that Doctor Clarence Van Epps found considerable sensation to be preserved on the forehead and cheek. These findings were so incredible to me at the time that I thought they did not represent somatic sensibility. I saw the patient again one year later and was fully convinced that

the residual was somatic sensibility. The patient has since died of natural causes but I feel it worth while to report a diagram representing the results of the examination after the partial root section. See fig. 7. While the findings in this patient are not the exact reverse of those when only a small amount of the ophthalmic fibers are left, they are reasonably so and indicate the wide distribution subserved by a few root fibers.

3. What proportion of the root should be cut to abolish the pain of tic douloureux?

If the hypothesis concerning oral trigger zones as given here continues to prove valid for all or most cases, then no doubt the minimal section that will substantially dull the oral sensibilities would suffice. I am convinced that the section should never have to be as great as in the first three cases. I am equally convinced that the lower fibers of the root should be cut and it is probable that a section of the lower half or a little less may prove to be sufficient for most cases.

CONCLUSIONS

1. Oral trigger zones appear to play a very important role in the initiation of the painful seizures of tic douloureux. Therefore partial sections of the sensory root of the fifth nerve should be designed so as to dull or abolish oral sensibilities.

2. Intraoral sensation of fifth nerve distribution is supplied by the lower fibers of the sensory root just posterior to the ganglion and hence partial sections should be done from below upward in the root.

3. Minimal sections should be the objective so as to obtain the best physiologic results and at the present writing it appears that a section of no more than the lower half of the root would suffice to abolish the pain of tic douloureux in most cases.

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SUMARIO

1. La zona oral de gatillo parece jugar un papel muy importante en la iniciación del ataque doloroso del tic douloureux. Por lo tanto sección parcial de la raíz sensoria del quinto nervio debe diseñarse para amortizar o eliminar la sensibilidad oral.

2. Sensación intraoral de la distribución del quinto nervio se debe a las fibras bajas de la raíz sesitiva porteriore al ganglio y por lo tanto la sección debe de ser de abajo hacia arriba de la raíz.

3. Sección mínima debe de ser el objetivo para obtener los mejores resultados fisiológicos, y al presente tiempo de éste escrito parece ser que la sección de no mas de las fibras inferiores de la raiz son sufisiente para eliminar el dolor del tic douloureux en la mayoria de los casos.

RÉSUMÉ

1. Des certaines zones détentrices orales jouent une rôle important dans l'initiation des accès de douleur dans cette affection. Il en résulte que la section partielle de la racine sensorielle du cinquième nerf attenue ou abolit les phénomènes douloureux de la région orale.

2. La sensation intraorale due à la distribution du cinquième nerf est fournie par les fibres inférieures de la racine sensitive situées en arrière du ganglion. Les sections partielles de ces fibres doivent être faites de bas en haut.

3. Les sections minimales obtiennent les meilleurs résultats physiologiques La section de la moitié inférieure de la racine suffit dans la plupart des cas á abolir la douleur qui accompagne le tic douloureux.

Reducing the Operative Mortality of Intracranial Tumors*

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THE neurosurgeon is reminded almost daily by his professional brethren that his mortality for operations around the brain necessarily must be huge. Many neurosurgeons, unfortunately, have this same attitude toward their work and seldom trouble themselves to check up on their operative results. There is nothing that will stimulate the surgeon to work harder and more carefully than a critical statistical review of the cases he has operated on. "Statistics can be made to prove anything" is a statement as true as it is trite but to the surgeon himself his review can result only in untold benefit to himself and his patients. He owes it to himself, his profession and his patients to frequently take a sampling from his surgical cases. Naturally, it is impossible to make careful detailed studies of all those he operates on, but at least he can study a certain percentage of them from the standpoint of a particular problem, which will give him an idea of the trend the problem is taking.

In a recent statistical analysis covering two general hospitals (University of Colorado and Denver General Hospitals) over a period of five years, I found my case mortality for operations for intracranial tumors had been 8%. This included only fifty-five operations on fifty patients, but it is sufficient to give an accurate index of my probable mortality in the other hospitals in which I work, a detailed study of which is being undertaken at the present time. In every instance a major craniotomy was performed by a bone flap operation (if a supratentorial tumor) or by rongeuring out a hole (if in the posterior fossa); the tumor was found and either completely or partially removed. Considered as operative deaths were those occurring during the postoperative hospital stay, no matter how long that period might have been.

This study forced me to make an analysis of why even four cases out of fifty should die following a brain tumor operation. In this group of fifty cases, fifty-five operations were performed. There were four hospital deaths giving a mortality of 8% and an operative mortality of 7.2%.

TABULATION OF CASES

Type of Tumor	No. of Tumors	Percent of Tumors	Deaths	Operations
Meningioma	8	16	0	10
Glioma	26	52	3	28
Metastatic Malignancies	4	8	1	4
Craniopharyngioma	1	2	0	1
Pituitary Adenoma	2	4	0	2
Acoustic Nerve Tumor	4	8	0	5
Colloid Cyst	1	2	0	1
Perithelioma	1	2	0	1
Granuloma	1	2	0	1
Angioma	2	4	0	2
TOTAL	50	100%	4	55

Operative Mortality—7.27%
Case Mortality—8%

An analysis of the four fatal cases gives this interesting information:

CASE 1 was a huge, recurring glioblastoma multiforme involving the right occipital lobe and extending into the right parietal lobe. It was planned to remove the right hemisphere entirely, but on exposure it was deemed advisable to try to save the face and arm centers. The dissection was carried down very near to the midline and even then it was not entirely removed. The patient died several days later from postoperative edema aggravated by tumor infiltration into the midline structures.

Comment. Operative mortality could have been avoided by acknowledging defeat when the histological

*Presented at the Third International Assembly of the International College of Surgeons held in Mexico City, August, 1941.

nature of the tumor had been determined. On the other hand extensive resection of the mass offered the only hope to the patient. Again it was impossible to estimate the depth of the tumor without proceeding with its radical removal.

CASE 2 was that of a tumor one inch in diameter located in the right face center and on the surface. It was removed without difficulty and it was recognized as a malignant nodule with other similar lesions in the brain. Death occurred one week later from signs of general cerebral edema. Autopsy showed two other nodules not more than one inch in diameter in the opposite cerebral hemisphere. Each had massive areas of edema about them which involved almost the entire brain structure. The tumor proved to be a metastatic hypernephroma. On several other occasions I have seen extensive swelling around hypernephroma nodules similar to that seen in this case and it would seem to be a characteristic reaction to this type of growth.

Comment. It is difficult to see how a mortality could have been avoided in this case as the primary growth and lung metastasis were too small to be diagnosed.

CASE 3 was a medulloblastoma loosely entwined about the brain stem of a three year old child. It came away so easily that I was encouraged to attempt its complete removal. More than half of it was removed without hemorrhage although it was an extremely tedious procedure. The operation was discontinued to be completed at another time. Death occurred twenty-four hours later. Autopsy showed no metastasis and that its complete removal would have been possible.

Comment. A mortality could have been avoided in this case by not attempting to remove a tumor of this type. Most neurosurgeons are satisfied by verifying these lesions at operation and following with x-ray therapy. This would have been a better plan to have followed in this case.

CASE 4 was a deeply infiltrating glioblastoma multiforme of the left frontal lobe and corpus callosum which had produced a swelling of the midline structures. Only tissue for a biopsy was removed. The patient was stuporous and in bad general condition prior to the operation and I probably now would consider her too sick for surgery.

Comment. This case can definitely be credited to poor preoperative judgment.

Harvey Cushing, in 1922, reported an operative mortality of 16.9%; later, in 1930, of 6.8%. Little or nothing has been said about operative mortality in removing intracranial tumors since. With all of our past experience and new methods of diagnosis and improvement of surgical technic, an 8% mortality is still too high. How can the risk be lessened to the point where we can assure the sufferer from an intracranial tumor that "If we can do him no good, at least we will do him no harm."

Neurosurgery, as a specialty, may be said to have been born through the combined studies of Harvey Cushing[1] at the Johns Hopkins Hospital and Charles Harrison Frazier at the University of Pennsylvania. Sporadic attempts at the removal of intracranial tumors prior to their time were only futile, hopeless efforts resulting in a prohibitive mortality. The discovery of air as a contrast medium for the diagnosis and localization of intracranial lesions by Walter Dandy[2] of the Johns Hopkins Hospital added to and made secure the position of surgery of the nervous system among the specialties.

The clinical diagnosis of surgical lesions of the cranial cavity at the present time is as accurate as the clinical diagnosis of deep-seated lesions in any other part of the body. Precision of the neurological diagnosis, with its fortification by means of x-ray of the skull with air inside of the cerebrospinal fluid bearing spaces, has made the exact localization prior to operation a thing of unquestioned accuracy. Therefore the surgical approach as to location at the present time is a matter of precision probably equaled by the localization of no other deep-seated disorder in the human body.

For a successfully accomplished operation the fundamental principles of general surgery must be applied in neurosurgery to the utmost degree of meticulous care. These are—the prevention and restoration of hemorrhage, the avoidance of sepsis and tissue trauma and safety in anesthesia. To the skilful handling of these four essential problems must be added accuracy in the diagnosis, care as to the preoperative, operative and postoperative details and last, but not least, that great immeasureable, intangible thing commonly referred to as surgical judgment.

Hemorrhage is largely prevented by placing the patient during the operation in as nearly the erect posture as it

is possible so as to eliminate venous congestion in the parts to be operated on. Infiltration of the surface structures by normal salt solution with adrenalin will further prevent bleeding. The skilful use of a suction apparatus will so clear the operative field when hemorrhage has occurred as to make the bleeding point visible for its control by the electro-coagulator. This machine is indispensable when arresting hemorrhage in intracranial operations and its use has reduced shock and bleeding to a minimum. Silver clips formerly used for this purpose have been almost entirely displaced by the use of the electro-coagulating machine. Bleeding causes shock, shock is prevented by restoring blood to the patient as it is lost. This is facilitated by the preoperative placing of an intravenous needle or cannula of such size that the transfused blood (citrated) can flow readily into the patient's vascular system with the same speed that it is leaving through the cut vessels. Never should a patient's blood pressure be permitted to drop below a systolic of 90. Blood must be kept on hand in anticipation of its use.

Sepsis occurs from three sources: systemic infection, contamination from the respiratory tracts of the patient or operating room personnel, and from unsterile dressings, instruments and suture materials. Systemic infection is avoided by close attention to the eradication of grossly infected foci prior to the operative procedure. Necrotic teeth and infected tonsils are to be removed before the operation wherever practicable. Vagrant organisms in the blood stream will localize themselves and multiply in surgically damaged tissues. Avoidance of sepsis from contaminating skin organisms is prevented by scrupulously cleaning the skin. It is quite probable that a skin well cleansed with soap and water will suffice to prevent infection in a surgical wound but the test of time has shown that germicidal agents added to this preparation are unquestionably more efficacious in preventing operative infection. Germs from the respiratory tracts of the patient, operating personnel, and spectators—spread by talking, coughing and sneezing — are probably the most common cause for operative infection following surgery in previously uninfected wounds. The certain sterilization of instruments, drapes and dressings is no longer a problem. In clean surgery, sutures of silk have proven their superiority over catgut.

The avoidance of tissue trauma is of greater importance in brain surgery than in surgery of any other part of the body. Delicate tissues must be handled in removing tumors, for example, from off an optic nerve, medulla oblongata or from the pineal, third ventricle, or hypothalmic regions. Yet it is a common experience for the neurosurgeon to remove large tumors from these locations with little damage to them and in most instances their function is restored by the removal. It is here that profound judgment and the greatest skill are necessary in order to estimate the trauma the tissue will stand and to prevent irreparable damage to vital parts.

The anesthetic must be one with which the anesthetist and the surgeon are fully familiar. The simplest forms of anesthesia—such as a solution of novocaine, or general ether anesthesia with the ether drop method—are to be preferred except in the hands of the very expert. Local anesthesia is probably the safest, but with a non-cooperative patient it may be the most dangerous; so it is necessary that the temperament of the patient be evaluated before attempting to perform a major operation under it.

Of the general anesthetics, it is prob-

able that a skilfully given intratracheal ether anesthetic is the safest. Again it must be emphasized that the anesthetist must be thoroughly acquainted with the technic of an intratracheal intubation. An intratracheal tube too tightly fitted will cause disastrous swelling of the tissues with the necessity of a postoperative tracheotomy on a patient who already has all that he can stand. Another danger in intratracheal anesthesia is the danger of using a tube which is too soft and which will collapse on bending. Probably the greatest percentage of neurosurgical operations are done with a basal anesthesia of avertin, 90 mgs. per kilo of body weight, supplemented by an open inhalation of ether. Ether-oxygen, ethylene and cyclopropane are not to be advised for neurosurgical procedures requiring the use of the electrocoagulator, suction machine, or other electrical apparatus because of their explosive character. With these anesthetics, the operating room humidity must be kept high and all metallic equipment grounded to prevent explosion from static electricity.

An accurate preoperative diagnosis and localization by neuroclinical methods are essential. If the localization is not certain, the clinical impression must be fortified by a ventriculography or encephalography. The operative mortality for intracranial lesions is very much increased by the necessity of attempting to remove a tumor through a bone opening in the skull not precisely placed over the tumor.

Never should a patient undergo any operation, much less a brain operation, without being in satisfactory condition to withstand the operative ordeal. To operate on a person who obviously is in no condition to withstand the operation is the poorest kind of surgical judgment. The estimation as to whether or not the particular patient is a satisfactory surgical risk for the operation proposed probably only comes to the operator with wisdom gained by years of experience. Many patients come to the neurosurgeon in metabolic bankruptcy from lack of fluids and nourishment. The administration of fluid, food and blood will often transfer a hopeless surgical risk to one who quite easily and safely goes through the most major operative procedure. A patient comatose, with a respiratory rate above 30, a fast pulse and high temperature, should never be operated on.

It is my impression that if proper care is given to the patient before the operation and if the operative procedure is carried out skilfully, then there is little need for any unusual postoperative care. If the patient's condition is satisfactory when he leaves the table, if the trauma to the tissues operated on has not been excessive, then we should expect a smooth, uneventful convalescence in operations for intracranial tumors the same as we should expect the same kind of convalescence in other types of surgery. For this reason, I should very much rather emphasize the care to be given to the patient up to the postoperative period than to give undue attention to the patient during the postoperative convalescence.

Postoperative intracranial hemorrhage should be cared for at the time of the operative procedure, and with careful surgical technic it will seldom occur. The same thing can be said for postoperative bankruptcy in any form. All are due to either poor surgical technic or faulty preoperative judgment. Obviously, a patient who does not pass through the operative period in good condition should not have been operated on in the first place. The postoperative

care then reduces itself to the problems that are common to any type of surgery. The head should be elevated to reduce edema in the tissues traumatized. The patient should be given sufficient food and fluid to take care of metabolic needs. Sedation should not be carried to the point where the patient is so stupified he is unable to clear the air passages. The wound should be kept well covered to prevent skin contamination and infection. The skin sutures should be removed in the first forty-eight hours so that irritation to the skin from these materials will not take place.

Hyperthermia is no problem in the majority of brain operations. If it should occur, it may be controlled by applying moisture to the skin and facilitating rapid evaporation by placing a fan where it will blow on the patient. Hyperthermia at high altitudes such as we have in Denver is exceedingly rare. The dryness of the atmosphere cools the skin and makes altitudes at a mile high exceedingly desirable for this type of surgery.

Oxygen should be supplied to a patient where aeration is not adequate as deprivation of oxygen from edematous tissues is apt to lead to a vicious cycle with more edema and more deprivation of oxygen. Oxygen administration in elderly folks should start very early because of the very much depressed metabolic activity of the tissues in these individuals.

Occasionally restraint is necessary. A patient mentally confused should not be restrained by sideboards on the bed. This only makes a barrier which causes the patient to fall from a greater height than if he were in the bed without them. In these patients physical restraint by means of leg and arm cuffs must be used. It is perfectly permissible to use sideboards on patients who are suffering from convulsions. It goes without saying that from the standpoint of sedation morphine is not advisable in the postoperative care of neurosurgical cases. Codein is to be preferred.

Last of all, the neurosurgeon must have the most mature surgical judgment. This judgment must be based on experience gained from the association with older men of experience in the same field. At one time it was permissible for any surgeon to tackle the removal of an intracranial tumor. At the present time, there are trained neurosurgeons in every community who can skilfully handle these problems. By the same token, however, it is no longer permissible for poorly trained neurosurgeons to go out on their own until they have adequately matured by years of experience under an older neurosurgeon's guiding hand. When is a patient a satisfactory operative risk for the procedure anticipated? How much hemorrhage and how rapid a loss of blood can the patient stand at the operation? How fast must the hemorrhage be replaced? To what extent will vital tissues be traumatized in the proposed operative procedure, and will these traumatized tissues recover to the point of leaving a viable, useful patient? These questions can be answered only in the light of profound surgical judgment based on adequate neurosurgical experience.

The surgeon must critically analyze his own ability, his own skill, and his own judgment in answering these questions. He may be certain that the loss of any life following an operation performed by him was lost through lack of an accurate prognosis which means nothing other than a lack of skill and mature surgical judgment — both of which are so necessary when dealing with surgical problems of the brain.

SUMMARY

The author reduced his operative mortality for intracranial neoplasms to less than 7.2 per cent in a five-year period, 1935 to 1940, by (1) exact localization prior to operation by precise neurological diagnosis supplemented by x-ray; and (2) meticulous adherence to the fundamental principles of general surgery.

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SUMARIO

Reducción de Mortalidad Operatoria en Tumores Intracraneales

El autor reduce su mortalidad operatoria por neoplasmas intracraneales a menos de 7.2% en un periodo de cinco años, 1935 a 1940, por (1) localización exacta antes de la operación por un diagnostico preciso neurológico suplementado por rayos-x; y (2) adherencia meticulosa a los principios fundamentales de cirugía general.

RÉSUMÉ

De 1935 à 1940, la mortalité operátoire des néoplasmes intracrâniens fut réduite dans les cas de l'auteur à 7.2 pour cent. Il est essentiel dans les cas de cette nature d'obtenir une localisation exacte préoperatoire par un diagnostic neurologique précis, dans lequel les rayons x jouent un rôle important. Une adhérence méticuleuse aux principes fondament aux de la chirurgie générale est de rigueur.

CHAPTER NEWS

Brazilian Chapter

The Brazilian Chapter of the International College of Surgeons was formed on April 20, at Rio de Janeiro. The following officers were elected:

Dr. Jorge Gouvêa, Honorary President
Dr. Oswaldo P. Campos, President
Dr. Estellita Lins, First Vice-President
Dr. Jorge Grey, Second Vice-President
Dr. Dagmar Aderaldo Chaves, Third Vice-President
Dr. João da Costa Monteiro, First Secretary
Dr. Domingos Guilherme da Costa, Second Secretary
Dr. Leonidus Cortes, Treasurer

Turkish Chapter

The Turkish Chapter of the International College of Surgeons was formed, with the approval of the Turkish Government, under the leadership of Professors Mehmet-Emin Erkul, Hazim Bumin, and Fahri Arel, according to cabled advice.

Venezuelan Chapter

The Minister of Education of Venezuela has apprised Dr. Herman de Las Casas, President of the **Venezuelan Chapter of the International College of Surgeons** that hereafter the Venezuelan Chapter will enjoy free mailing privileges to all parts of the globe.

The Therapy of the Neurogenic Bladder*

HAROLD C. VORIS and HERBERT E. LANDES

CHICAGO, ILL.

THE proper treatment of disturbances in bladder function and the consequent upper urinary tract pathology resulting from diseases or injuries of the central nervous system is of paramount importance to these unfortunate patients. In fact the length of life of those surviving the immediate effect of severe and permanent spinal cord injury is to a large extent determined by the type of care accorded the paralyzed urinary tract. Sequelae such as stone formation, cystitis, ascending pyelitis, pyelonephritis, renal insufficiency and finally death from uremia are all too frequently observed. Serious urosepsis delays or prevents completely the restoration of partial bladder function, the so-called automatic or reflex bladder. Head and Riddoch have shown also that prolonged severe urosepsis is associated with general degenerative changes in the central nervous system. From these facts it is evident that the prevention of serious infection in the paralyzed urinary tract is of prime importance.

This fear of urosepsis gave rise to a school headed by Young and composed largely of urologists with considerable war experience, which condemned instrumentation for the relief of the overdistended paralyzed bladder. Since alarming overdistension results neither in spontaneous rupture of the bladder nor urinary suppression, many cases have been managed in this manner. Unfortunately, mere refusal to instrument these patients is no guarantee against infection of the urinary tract, for like all other patients who carry residual urine they will ultimately develop infection due to urinary stasis alone.

Stimulated by additional knowledge of normal and disturbed bladder physiology obtained by cystometric examinations, as well as by the discovery of new and amazingly effective urinary antiseptics, we have treated a large number of patients with acute traumatic myelitis, using various forms of early bladder drainage with results in many ways superior to those treated by the "hands off" policy.

Cystometry enables one to study the behavior of the urinary bladder during artificial filling. A record of bladder pressure together with a simultaneous record of certain subjective phenomena constitutes the cystometrogram. Cystometry, while not absolutely essential, is invaluable in the diagnosis and treatment of the neurogenic bladder. It is of value in differentiating the general level and extent of lesions which interrupt either the motor or sensory side of the pathways concerned in bladder function. It is equally valuable in checking the progess of the patient under treatment. However, careful clinical observation plus the frequent use of the catheter to determine the presence and amount of residual urine can be substituted for the cystometer.

A number of methods for studying

* From the departments of neurologic surgery and urology, Loyola University School of Medicine and Mercy Hospital-Loyola University Clinics.

bladder pressure have been devised. Personally we feel that a continuous recording type of instrument such as that devised by Landes and Voris and by Lewis is essential.

Since the surgeon most frequently meets with disturbances of bladder function of neurologic origin in cases of injury to the spinal cord or cauda equina and since the need for adequate treatment at the onset is very great, we shall consider this problem first.

Following an acute injury of the spinal cord or cauda equina, there is a period of inactivity of the bladder as far as reflex activity is concerned. This has been referred to by Munro, Nesbit and Gordon, and McLellan as the stage of the acute atonic neurogenic bladder. It is recognized clinically by a gradually increasing distension of the bladder which may reach the level of the xyphoid before more or less continuous urinary dribbling occurs. This overflow incontinence is delayed until the resting level of pressure in the bladder reaches a point sufficient to overcome the slight tone maintained by the external sphincter. Voris and Landes have shown by cystometric studies that in a very short time these bladders regain sufficient tone so that during progressive filling with successive fifty cc. increments of fluid there is a succession of step-like peaks and new resting levels with additional injections, each higher than its predecessor. They noted the similarity of the cystometrogram in these patients to that obtained in patients under spinal anesthesia and considered that it represented a true stretch reflex, due to a pathologic failure of the musculature of the bladder to accommodate itself to filling.

Of great importance is the high resting level of pressure that was noted in these bladders after the injection of several hundred cubic centimeters of fluid (Fig. 1). This level of pressure averages about forty mm. of mercury. Obviously, if the bladder is allowed to over-distend after an acute transverse lesion of the spinal cord or cauda equina, the kidneys are forced to secrete against a tremendous back pressure. Ureteral peristalsis protects the upper tract to some extent from back pressure effects, but in serious spinal cord injury the effectiveness of the uretero-vesical valves as well as normal ureteral move-

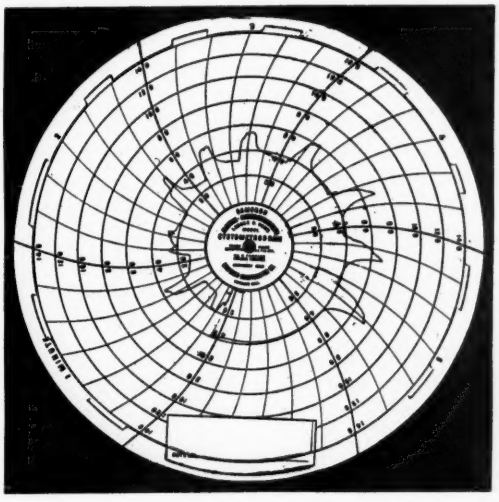

Fig. 1. Cystometrogram of a patient with an acute transverse lesion of the thoracic portion of the spinal cord. Note the failure of the bladder pressure to return to the base line after each increment of filling and the step-like rise in pressure following each injection. A total of 500 cc. of fluid was injected and after that a level of about 40 mm. (mercury) of pressure was maintained.

As in all the cystometrograms shown, the period of injection of each 50 cc. of fluid, the desire to void (when present), and the period of voiding are indicated on the margin of the tracing. Each radial line denotes a period of ten seconds. The concentric circles indicate pressure expressed in millimeters of mercury.

ments are seriously disturbed. The remarkable adaptability of the normal bladder to accommodate itself to filling with only a very slight rise in pressure, the highly competent uretero-vesical valves, and normal ureteral peristalsis

are all designed to protect the kidneys against sudden changes in intrapelvic pressure. The normal pressure in the kidney pelvis is very slight and sudden elevation of this pressure which sometimes takes place during retrograde pyelography will cause the kidney to stop secreting urine for many hours. Likewise, the deleterious effect on renal function of all the mechanical obstructions to urination have long been recognized by urologists. These facts alone should be ample reason for providing some form of bladder drainage immediately after an acute injury to the spinal cord or cauda equina.

Another cogent reason for providing bladder drainage in these patients with acute spinal cord injury is the increased nursing care that an overflow incontinence entails. Furthermore, even with the most frequent changes of bed linen it is almost impossible to keep these patients dry and consequently the development of bed sores, such a serious complication in these patients, is promoted.

TYPES OF BLADDER DRAINAGE

Three types of bladder drainage because of their simplicity and ready availability may be considered in the management of acute retention resulting from traumatic myelitis. They are interval catheterization, and continuous drainage either by indwelling urethral catheter or by the suprapubic catheter.

One cannot overemphasize the importance of employing the most rigid aseptic technic in instrumenting these patients. Any type of catheterization is a surgical procedure and should be done with full regard for asepsis and the avoidance of trauma. The anterior urethra of the male is the habitat of numerous organisms which if carried into the paralyzed bladder by an instrument may cause a serious acute urosepsis. Copious irrigation of the anterior urethra with a mild antiseptic such as 1-4000 potassium permanganate just prior to catheterization should be a routine procedure. Likewise, the catheter should be handled with sterile forceps.

The most meticulous care will not completely eliminate infection in these patients. It can, however, be controlled in most cases by the judicious use of the newer urinary antiseptics. Routine urine cultures will establish the type of organism present and aid in the selection of the appropriate urinary antiseptic. Sulfathiazole has proved to be particularly effective against the staphloccus, and mandelic acid preparations in a highly acid urine will generally control infections due to the colon group of organisms. Proteus infections are particularly serious because their urea-splitting property renders the urine so alkaline that bladder ulcerations, incrustations, and phosphatic bladder calculi are frequent complications. Most of the urinary antiseptics so far developed are ineffectual against these organisms. Frequent lavage of the bladder with 0.5% phosphoric acid is the most effective treatment.

If the paralyzed bladder is to be treated by drainage, which we believe to be the method of choice, it should be instituted early, before the bladder has become greatly over-distended. Overstretching of the paralyzed detrusor muscle may injure it still further, and the disturbed circulation produced by over-distension predisposes the bladder to early and severe infection.

Intermittent catheterization. It can at once be said that intermittent catheterization is unsatisfactory. Not only is it time consuming and exacting if bladder distension is to be avoided, but it also multiplies the possibilities of infecting the bladder. Since the bladder is emptied only periodically, there is most of the time a partially filled reservoir of infected urine under more or less pressure.

Constant drainage. Constant drainage, on the other hand, keeps the bladder empty at all times. It not only reduces the number of instrumentations to a minimum, but it also keeps intravesical tension at zero, and thus protects the upper urinary tract from back pressure and minimizes the possibility of infection from reflux of infected urine from the bladder into the kidney pelves. It also keeps the paralyzed bladder small and at rest and provides for efficient lavage of the viscus.

The choice then lies between urethral and suprapubic retention catheter drainage. The urethral catheter, if properly cared for, may be worn indefinitely. A No. 18 to 22 F., double eye, hollow tip catheter should be passed so that its tip projects not more than 2 cm. inside the bladder. A small quantity of injected fluid will return promptly if the catheter is properly placed. The catheter should be held in by adhesive tape and it should be removed, sterilized and the urethra thoroughly irrigated twice a week. It is best to perform bilateral ligation of the *vas deferens* at the time of the initial installation of the indwelling catheter to prevent possible development of epididymitis. This latter complication is rare however, even in cases where the precaution of ligation of the *vas* is not carried out.

Drainage by suprapubic catheter, although a surgical procedure, has certain advantages over the urethral retention catheter. Where suitable instruments and operative facilities are available, we regard it as the method of choice. It may be done according to the Thorburn technic. A five cm. median incision, its lower extremity at the symphysis, is carried down to the bladder. With the bladder filled to 500 cc. or more, the peritoneal reflexion will be out of danger. An ordinary forceps held closed, is passed through the bladder wall and then the blades are supported just enough to permit the introduction of a self-retaining suprapubic tube stretched on a long probe. When the forceps is removed and the probe withdrawn, the tube will be tightly gripped by the bladder wall and the junction will be watertight. A still simpler method requiring no skin incision is that devised by Duffy. His special trochar permits the easy introduction of a No. 24 F. winged catheter through the abdominal wall and into the distended bladder with a resulting watertight junction.

This latter method, in our opinion, is the simplest and most effective method of draining the paralyzed bladder. Some form of closed irrigation and constant drainage apparatus should be used. Fig. 2 (a) is a diagram of an apparatus that provides for continuous drainage of the bladder and intermittent irrigation with a mild antiseptic. A Foley catheter is used, the dilated bag serving to retain the catheter in the bladder. This type of catheter is especially desirable for women. The entire apparatus is assembled and sterilized as a unit. It is our practice to change the indwelling catheter every five days. At this time the catheter is removed and the entire assembly is cleaned and resterilized before reinsertion of the catheter.

Fig. 2 (b) illustrates an apparatus for constant irrigation as well as constant drainage of the bladder. An Alcook catheter is used in this set-up which is also assembled and sterilized as a unit. The air-inlet of the reservoir as shown in the diagram is connected to the air-outlet of the drainage bottle. Landes has found this addition to the original apparatus to be of value in cases of obstruction to the lower urinary tract because if either channel of the catheter becomes blocked, inflow of fluid into the bladder stops; this can at once be recognized by glancing at the Murphy drip bulb. It is obvi-

ous that a slight positive pressure will develop into this closed system because the volume of the irrigating fluid is increased by the addition to it of the urinary output. This positive pressure in the system if not released by momentary removal of the stopper from the drainage bottle, will interfere with the emptying of the bladder through the out flow tube and the bladder will distend. It is necessary to carry out this equalization of pressure every two or three hours. In cases of neurogenic bladder disturbance there is little likelihood of the catheter becoming clogged and consequently this connection is usually omitted, thus simplifying the apparatus.

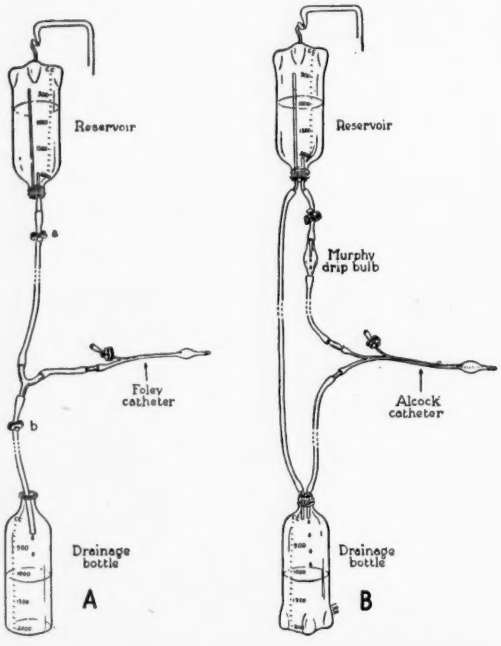

Fig. 2. (a) Diagram of apparatus for continuous drainage and intermittent irrigation of the bladder. The upper clamp (a) is normally closed while the lower clamp (b) is kept open. When it is desired to irrigate the bladder (b) is closed and (a) is opened until 100 cc. of fluid have run into the bladder. Then (a) is again closed and (b) opened which completes the process until irrigation is again necessary.

(b) Diagram of apparatus for continuous irrigation and drainage of the bladder. The flow of the irrigating fluid is regulated by the clamp above the Murphy drip bulb. Periodic (every two to three hours) opening of the drainage bottle to equalize pressure is necessary.

Munro has advocated the use of "tidal drainage" in these patients. This apparatus provides an intermittent irrigation with automatic filling and emptying of the bladder. It is somewhat complicated and requires closer and more intelligent supervision than either of the two methods previously described. Advocates of this apparatus claim that it hastens the appearance of reflex activity in the bladder. Since this is primarily a function of reflex centers in the sacral spinal cord it is difficult to see how "passive exercise" of the bladder musculature can have much effect in this direction. In our experience the apparatus pictured in Fig. 2 (b) is much simpler than Munro's and is more satisfactory.

After a variable interval of time, usually several weeks or more, reflex activity of the bladder appears and in favorable cases a so-called automatic or reflex bladder develops. This may occur more rapidly in incomplete lesions of the spinal cord. The general condition of the patient with freedom from urinary sepsis, trophic ulcers and so on is of great importance in promoting its development. By means of frequent cystometrograms, it is possible to record the various stages of the development of reflex activity, beginning with the earliest small weak irregular contractions. From a practical standpoint the classification of the various stages is hardly worthwhile; in fact, there are many individual variations which are difficult to fit into any rigid scheme. The important thing to ascertain is the point at which the reflex contractions occur regularly with a known degree of filling, and are forceful enough to either completely empty the bladder or leave only a small amount of residual urine (less than fifty cc.). At this time catheter drainage, whether urethral or suprapubic, can be

discontinued. This stage is that described by McLellan and Nesbit and Gordon as the "reflex neurogenic bladder."

Unfortunately, both physician and patient are usually still disappointed at this stage. Nursing care is complicated because of frequent involuntary voiding of urine. The capacity of these bladders is usually 150 cc. or less; Voris and Landes have pointed out the physiologic reasons why a greater capacity cannot be expected. Male patients can of course wear some form of urinal; such devices are much less satisfactory for the female patient.

Reflex or automatic micturition in these patients is often associated with the mass reflex but is not actually part of it, as Holmes, and later Langsworthy, showed. Denny-Brown and Robertson demonstrated that reflex micturition may be initiated directly by stimulation of cutaneous areas innervated by the sacral segments. If patients can learn to do this they may be able to control the emptying of their bladder and avoid the use of a urinal, at least during the waking hours.

Lesions of the sacral cord or of the cauda equina or both (involving the second, third, and fourth sacral segment or their roots) give, in the acute stages, the same clinical and cystometric picture as lesions in the spinal cord above the sacral level. The end result of such lesions has been termed the autonomous neurogenic bladder by Munro, Nesbit and Gordon and McLellan. Reflex activity is slower to develop and the height of the pressure developed during bladder contractions is less. The parasympathetic preganglionic motor neuron, with its cell of origin in the gray matter of the second, third and fourth sacral segments, has been cut off from the postganglionic neuron in the bladder wall or the mural ganglia, and the reflex activity that does develop is due to the activity of the latter neuron; hence the term autonomous. Voris and Landes emphasized an outstanding characteristic of the cystometrograms (Fig. 3) in these cases. It is the tendency of the bladder after partial filling to show a series of irregular, arrhythmic, small, poorly-sustained contractions. This phenomenon is diagnostic of such lesions.

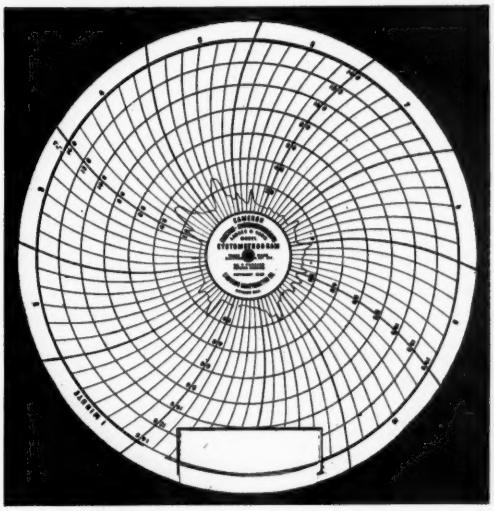

Fig. 3. Cystometrogram of a patient with a long standing lesion of the cauda equina. This tracing was made after the injection of 125 cc. of fluid into the bladder. The small, irregular, arrhythmic, poorly-sustained bladder contractions characteristic of a chronic lesion of the cauda equina are well shown.

The management of the bladder in acute cases of injury to the sacral portion of the spinal cord or the cauda equina is the same as for injuries at higher levels. Since neurologic disability is not so complete in these cases, many patients become more or less ambulant even before reflex activity is regained in the bladder. Straining plus manual suprapubic pressure enables many of these patients (if cooperative) to empty their bladders even if the bladder contractions themselves are inadequate. Constant drainage by urethral catheter or suprapubic cystotomy must be main-

tained until the patient can empty his bladder leaving a residual of less than 50 cc.

TRUE ATONIC NEUROGENIC BLADDER

We have already pointed out that the so-called "atonic" bladder following acute transverse lesions of the spinal cord is not truly atonic. There is, however, a true atonic neurogenic bladder. It is seen characteristically in tabes dorsalis and inconstantly in a number of other neurologic conditions as pernicious anemia (sub-acute combined degeneration), multiple sclerosis, syringomyelia, etc. In fully developed cases with even 1000 cc. of filling (Fig. 4) there is no rise in bladder pressure and no sign of bladder contraction. In some cases there is considerable discomfort with overdistension, in others there is merely consciousness of bladder distension.

Obviously in these patients there is loss of the normal emptying reflex of the bladder and marked impairment of sensation. The loss of reflex contractions is due in part—if not in whole—to reduction of afferent impulses from the bladder wall. These are not necessarily impulses that reach consciousness, for reflex contractions can and do occur when the sacral segments of the cord are cut off from higher levels. On the other hand, with acute lesions of the lower dorsal or lumbar portions of the cord, the patient may be conscious of distension of the bladder but have no sign of bladder contractions.

Since there is no increase in bladder pressure during filling in these patients, the kidneys do not have to work against any back pressure and artificial drainage is not so imperative. Dilatation of the upper tract when seen in these patients is due to chronic infection rather than to back pressure. When these patients are ambulatory, either a urinal or periodic emptying of the bladder by abdominal straining is often satisfactory. In bed-

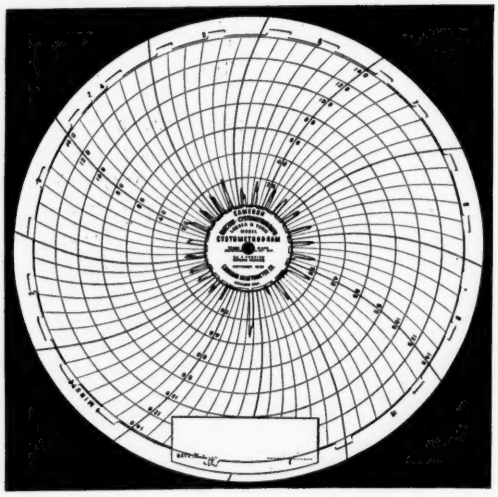

Fig. 4. Cystometrogram of a patient with tabes dorsalis. No bladder contraction and no rise in the resting level of intra-vesical pressure was noted with even 1000 cc. of filling. During the final minute of the tracing no fluid was injected, but the effect on bladder pressure of first, a cough and second, voluntary straining are shown on the tracing.

ridden patients catheter drainage or suprapubic cystotomy may be necessary. Such patients should never be treated with intermittent catheterization, since in the intervals between catheterization the retained urine acts as an excellent culture medium for bacteria. We have found that a satisfactory bedside urinal can be devised for the male by slipping an ordinary condom partially over the penis and sealing it at the base with adhesive tape. The end of the condom is opened and a rubber drainage tube is slipped inside and the condom strapped tightly around the tube with adhesive or cellulose tape. The drainage tube is led to the waste bottle beneath the bed. This device obviates the necessity for urethral or suprapubic drainage since it keeps the patient dry. It should be changed every few days and the penis thoroughly cleansed. In the female patient urethral or suprapubic drainage may not be necessary.

As a result of lack, or the loss, of normal cerebral inhibition of bladder contractions as seen in many neurologic conditions (e.g. multiple sclerosis, subacute combined degeneration, cord tumors, cerebral arteriosclerosis, cerebral vascular accidents, brain tumors, cerebral trauma, etc.) the patient may show more or less urgency both day and night with precipitate micturition and perhaps enuresis. The cystometrogram in these patients is typical whether the cause is functional or organic (Fig. 5). The desire to void appears at about the usual time, viz., 150-250 cc. of filling. However, a bladder contraction appears at this point or with another 50 to 100 cc. of filling. This is in contrast to the normal where a bladder contraction will not occur until 350-500 cc. of filling. This of course explains the urgency and the precipitate voiding or enuresis if such are present. Urgency is the chief indication for treatment. These bladders are seldom infected and they empty themselves very satisfactorily. Severe cases of this type correspond both clinically and cystometrically to the reflex bladder that develops after complete transverse lesions of the spinal cord; the milder cases more or less approach this. While the end result is the same, the manner of development is diametrically different in the two types of patient.

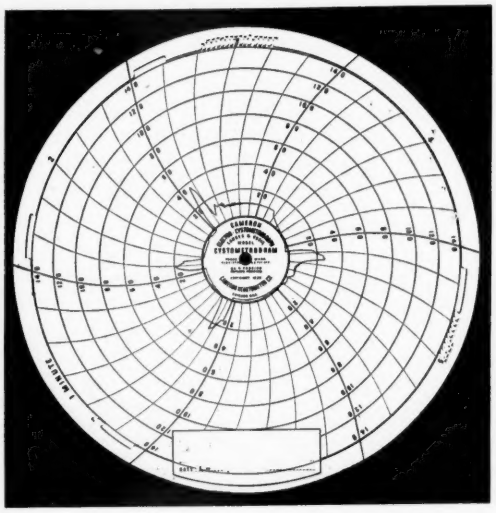

Fig. 5. Cystometrogram of a patient with a glioma of the right temporal lobe. After 150 cc. of filling there was a weak bladder contraction with voiding about the catheter. Another 50 cc. injection again produced a weak bladder contraction with voiding.

Treatment is symptomatic with tincture of belladonna, ten to fifteen drops four times daily as advised by McLellan and restriction of fluids after 4:00 P.M. to prevent enuresis. Severe cases may require a urinal to prevent soiling. In bedridden patients the device previously referred to may be used for the male. Large absorbent perineal pads best solve the problem in the female.

SUMMARY

1. The rational treatment of the neurogenic bladder has been neglected in the past, yet there is no other factor so essential to the health or comfort of these patients.

2. Cystometric studies are of great value in the diagnosis and management of the neurogenic bladder but if a cystometer is not available, careful clinical observation plus the use of the catheter to determine residual urine, enable the physician to manage these patients adequately.

3. Following an acute transverse lesion of the spinal cord or cauda equina, the bladder is not completely atonic but develops a considerable pressure during filling. In the authors' opinion, such bladders should be drained with the indwelling of suprapubic catheter.

4. The atonic bladder of tabes dorsalis develops little or no intravesical pressure and consequently constant drainage is not necessary unless the bladder contents are infected.

5. Bladders that are uninhibited and empty themselves precipitately do not require constant drainage except to keep

the patient dry and this can be accomplished usually with some form of urinal. Suprapubic drainage is never indicated in these patients as they will void intermittently through the urethra in spite of the presence of the suprapubic catheter.

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SUMARIO

1. El tratamiento racional de la vejiga neurogénica ha sido descuidado en el pasado, y aun no hay otro factor tan esencial para la salud y bienestar de estos enfermós.

2. Estudios sistométricos son de gran valor en el diagnóstico y tratamiento de la vejiga neurogénica, pero si un sistómetro no está al aleance, observación clínica cuidadosa mas el uso de un cateter para determinar el orine residual, ayudará el médico a atender el enfermo adecuadamente.

3. Siguiendo una lesión aguda tranversa de la médula espinal o cauda equina, la vejiga no queda completamente atónica, pero desarrolla una presión considerable al llenarse. Es la opinion del autor que tales vejigas deben de drenarse con un cateter permanente o suprapubico.

4. La vejiga atónica de la tabes dorsalis desrrolla poca o ninguna presión intravesical y por lo tanto drenage constante no es necesario al menos que su contenido se infecte.

5. Vejigas que no estan inhibidas y se y se vacian precipitadamente no requieren drenaje constante excepto cuando se quiere sostener el enfermo seco lo que se puede hacer usualmente con algun tipo de orinal. Drenaje suprapubico no es indicado en éste típo de enfermos porque ellos orinan intermitentemente a través de la uretra aunque tengan el cateter suprapúbico.

RÉSUMÉ

1. Le traitement rationnel de la vessie neurogénique a été négligé dans le passé; pourtant, il n'y a pas de facteur aussi essentiel au confort et au bien-être de ces malades.

2. L'étude cystométrique est d'une grande valeur pour le diagnostic et le traitement de la vessie neurogénique. Si un cystomètre n'est pas à la portie du médecin l'observation clinique et en plus l'emploi de la sonde à demeure pour se renseigner sur l'urine résiduelle permettrant au praticien d'instituer un traitement adequat.

3. Après une lésion transverse aigué de la moelle épinière ou de la queue de cheval, la vessie n'est pas complètement atonique, et elle développe une pression considérable durant son remplissage. D'après l'auteur, dans les cas de cette nature le drainage de la vessie doit être entretenu ou par la sonde à demeure ou par une sonde introduite dans un meat créé dans la région supra-pubique.

4. La vessie atonique du tabès dorsalis développe peu ou pas de pression intravésicale; il en résulte que le drainage n'est pas nécessaire dans ces cas. Une exception sera faite si la vessie ou son contenu sont infectés.

5. Les vessies qui se vident précipitamment ne demandent pas le drainage

constant. Dans ces cas, le port d'un urinal approprié suffit. Le drainage suprapubique n'est jamais indiqué chez ces malades car ils urineront par la voie urethrale malgré la présence d'une sonde suprapubique.

Honorary Fellowship in the **International College of Surgeons** has been conferred upon **Professor Nicolai N. Burdenko,** Chief Surgeon of the Russian Armies.

The recipient of this honorary fellowship was born in 1878 in Nizhni Lomov, Penza Province. During the Russo-Japanese War of 1904, he served in the front lines tending the wounded, for which he was awarded the Cross of St. George. He studied with I. P. Pavlov, and chose surgery for his life work. During the first World War he worked in the fields of shock, treatment of skull wounds, and injuries to the nervous system. In 1923, Burdenko was appointed Professor of the first Moscow State University where he carried on research on blood transfusion, surgery of the lungs, anesthesia, and operations on the nervous system. He was founder of the science of neurosurgery in the Soviet Union, occupying a place there comparable to that of Harvey Cushing in the United States.

Professor Burdenko is the author of numerous works on surgery of the liver, the pancreas, the lungs, the stomach, and the nervous system. He is a member of the Academy of Sciences of the U.S.S.R.; Chairman of the Scientific Council of the Commissariat of Public Health; President of the All-Union Association of Surgeons and editor of a number of scientific magazines.

He has been elected a Deputy to the R.S.F.S.R.'s Supreme Soviet as well as to the Federal Parliament. For his work on surgery of the nervous system, Burdenko received the highest government awards.

Intracranial Aneurysms of the Internal Carotid Artery and Its Branches*

WALLACE B. HAMBY, M.D.

PRIOR to the development of modern neurological surgery, which permits the antmortem differentiation of many obscure intracranial lesions, intracranial aneurysms were considered extremely rare, almost impossible to diagnose and, therefore, almost hopeless as to treatment. During the last fifty years the clinical picture has become more sharply defined and successful treatment more frequently effected. As in the case of other intracranial neoplasms, knowledge of the peculiarities of aneurysms within the cranium has increased until they no longer can be considered as a whole but must be differentiated clinically as to site and state of progression. Recently many excellent papers have outlined their clinical vagaries and have furnished guide posts pointing to their recognition, so no attempt will be made here to consider the subject exhaustively. Attention is drawn to the various types, of which a few examples are recorded.

Mr. Geoffrey Jefferson[11] has elaborated upon Edwin Bramwell's clinical classification to produce an excellent grouping according to the location of the lesion, exclusive of arteriovenous aneurysms of the internal carotid artery within the cavernous sinus.

I. *Apoplectic type* (producing subarachnoid hemorrhage without localization).

II. *Paralytic type.*

1. Aneurysms with paralysis of cranial nerves, usually the third.
2. Saccular (non-fistulous) aneurysms of the internal carotid artery within the cavernous sinus.
3. Basal aneurysms with affection of the visual pathways.

I. APOPLECTIC TYPE:

Sudden rupture of a small "berry aneurysm" of one of the component branches of the Circle of Willis produces a clinical drama that usually makes the diagnosis evident. The patient, usually a young adult, suddenly is seized with severe prostrating headache that may be accompanied by unconsciousness. Well marked signs of shock usually are present. On regaining consciousness the patient complains of excruciating pain, perhaps starting behind the eye, but rapidly spreading to the suboccipital region, producing nuchal rigidity and perhaps opisthotonos. The tendon reflexes at first are abolished but later may become hyperactive, with signs of meningeal irritation. This clinical course merits the performance of a spinal puncture, which confirms the diagnosis. The fluid is bloody and is under increased pressure. If the bleeding does not cease the patient eventually expires. If the leakage of blood ceases, the signs clear and the patient may be considered to have recovered, only later to have a fresh hemorrhage that may be fatal. While the prognosis in this type of case must be guarded, the evaluation of large series of cases[16] shows that it is better than had been believed formerly.

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CASE 1. Mr. T. U. (134-874), a powerfully built, thirty-two year old man was admitted to the Buffalo General Hospital on 7-1-'40. On 6-27-'40, while swinging a large sledge hammer, he had suddenly felt faint and had a shocking bifrontal headache with loss of vision for fifteen or twenty minutes. He was not unconscious but vomited three or four times. He was taken to his home where he remained in bed with severe headache until admitted to the hospital. On examination the patient was drowsy and appeared acutely ill. The neck was flaccid. The pupils were contracted and the corneal reflexes were absent. The deep and superficial reflexes were abolished. The neurologic examination otherwise was normal. The B.P. was 180/105. A lumbar puncture revealed heavily bloody fluid under pressure of 650 mm. of water.

Diagnosis was made of spontaneous subarachnoid hemorrhage, probably of aneurysmal origin. Lumbar puncture was repeated daily with gradual clearing of fluid, fall in pressure and relief of symptoms. The reflexes returned and no localizing signs were found. X-rays of the skull were normal, the pineal gland was visualized in the midline. The patient was discharged on 7-14-'40, to be kept under a regimen of restricted activity.

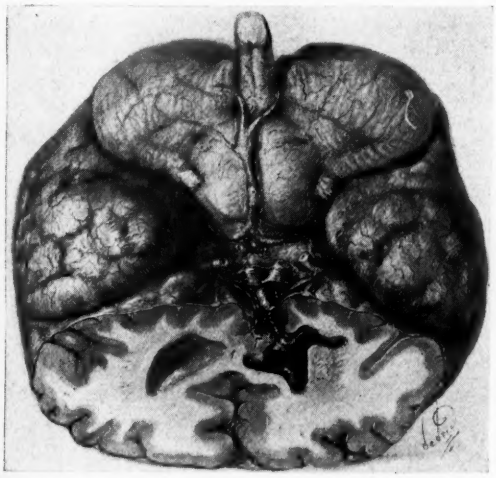

Fig. 1. Case 1. Aneurysm of right anterior cerebral artery with leptomeningeal hemorrhage and rupture into the right lateral ventricle.

Two months later the patient suddenly fell unconscious and died. Post mortem examination (Fig. 1) revealed distinct atheromatous changes in both anterior cerebral arteries with a "hazel nut" sized aneurysm about 4 cm. anterior to the anterior communicating artery, with rupture into the brain substance at the medial surface of the right frontal lobe about 3.5 cm. behind the pole and with very marked older hemorrhagic softening of the brain tissue behind this. The entire leptomeninges in this neighborhood showed marked hemosiderosis. The hemorrhagic softening had perforated the floor of the anterior horn of the left lateral ventricle. There was old hemorrhagic softening of the entire fornix. The ventricles contained a complete cast of recently clotted blood. There was marked recent swelling of the brain with distinct flattening of all gyri.

Comment: This case rather typically demonstrates the clinical course of a case of spontaneous subarachnoid hemorrhage originating in a small aneurysm on the anterior cerebral artery. The lesions may develop in congenitally weak vessel walls even in youth or in association with arteriorsclerosis in older patients. The associated hypertension in this case made a recurrence likely.

II. PARALYTIC TYPE:

1. *Aneurysms with paralysis of cranial nerves.* A nonleaking lesion of this category may simulate intracranial neoplasm so closely that its true nature is disclosed only at the operating table. A leaking one may simulate idiopathic subarachnoid hemorrhage except that isolated paralysis of a cranial nerve, perhaps mere dilatation of a pupil, may indicate its location. If the hemorrhage recurs and the location of the lesion can be determined clinically or by cerebral arteriography, attempt may be made to isolate the lesion by "trapping" it between silver clips at craniotomy. Accumulating reports in the literature prove that this may be successful; the author has not yet accomplished this. The report of an unsuccessful attempt will illustrate the characteristics of this group of cases.

CASE 2. Mr. R. M., (138-539), a forty-five year old clerk was admitted to the Buffalo General Hospital on 12-9-'40. While walking to church on 11-31-'40, he suddenly "felt something snap" in his head and had severe headache, tinnitus, vertigo, blurred vision and neck rigidity. He was not unconscious and managed to walk home where he remained, not completely confined to bed. Four days later the headache increased and he began vomiting severely. Pain radiated down the back to the sacrum and down both legs.

On examination, the cranial nerves were normal. The left tendon reflexes were hyperactive and Babinski's sign was present on the left. The B.P. was 182/112. Lumbar puncture revealed bloody fluid under increased pressure.

With daily spinal punctures, the spinal fluid pressure gradually fell, the fluid cleared and the signs and symptoms cleared up. The patient was discharged by ambulance on 12-23-'40. As he was being carried into his home, the symptoms suddenly recurred and he was brought back to the hospital. Lumbar puncture revealed fresh hemorrhage. Under treatment as before, the signs of meningeal irritation gradually cleared. On 12-29-'40 he complained of severe pain over the right orbit, then developed diplopia, dilata-

tion of the right pupil and a lag in all the eye movements. Fresh blood again appeared in the spinal fluid. Autohemotherapy was instituted. The fluid again cleared but he developed ptosis of the right lid, dilatation of the right pupil and fixation, protrusion and tenderness of the right eyeball.

Hemorrhages were recurring frequently and clinical signs now indicated the location of the lesion at or near the point of entry of the right internal carotid artery into the skull. On 1-7-'41 the chiasm was explored. A very thin walled aneurysm was found to arise from the junction of the internal carotid with the posterior cerebral artery. The lesion ruptured during exploration. Silver clips were placed on the internal carotid artery above and below the lesion and on the posterior cerebral artery just behind it, controlling the bleeding. This collapsed the lesion which then was coagulated by electrocautery and was surrounded by muscle packs. The patient never regained consciousness; he gradually developed complete left hemiplegia and expired five days after operation.

Post mortem examination revealed evidence of recent but no fresh subarachnoid hemorrhage. There was marked softening without hemorrhage, in the area supplied by the middle cerebral artery, including the entire internal capsule, globus pallidus and anterior part of the optic thalamus. The right hemisphere was swollen. Atherosclerosis was found in several of the cerebral arteries.

Comment: In retrospect, one may conclude that a more favorable outcome might have been obtained had the patient been subjected to a period of digital compression of the carotid artery and ligation of the artery in the neck prior to craniotomy. At the time, the patient's condition seemed so critically balanced that it was not deemed wise to subject the walls of the aneurysm to the "internal massage" that carotid compression would have produced. This decision was strengthened by the fact that the bleeding recurred spontaneously with the patient absolutely quiet.

2. *Saccular aneurysms of the internal carotid artery within the cavernous sinus.* After it enters the skull, the carotid artery (Fig. 2) makes an S shaped course within the cavernous sinus. It is in relation here to a number of important nerves within a very restricted space and its dilatation produces the "cavernous sinus syndrome." This has been called the syndrome of Foix, who described it in 1922[8], but as Jefferson[11] stated, it was described earlier by Bartholow[2] in 1872 and by Stopford in 1917. The syndrome was described by Adams[1] in 1869, but its diagnostic significance was not stressed at that time. The relation of various parts of the artery to its neighboring nerves allows the cavernous sinus syndrome to be divided into three parts. Jefferson's article[11] listed several examples of each type.

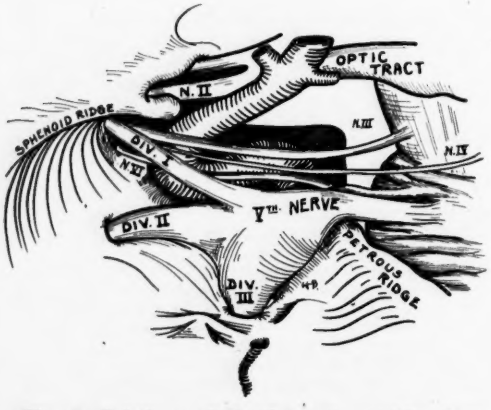

Fig. 2. Relations of the internal carotid artery within the cavernous sinus.

A. *Posterior cavernous syndrome:* Here the aneurysm presses upon the sensory and perhaps the motor root of the trigeminal nerve, producing pain and hypesthesia of the entire face. Ipsolateral ophthalmoplegia may be complete or may be confined to the sixth nerve alone.

B. *Middle cavernous syndrome:* Pressure of the aneurysm on the ophthalmic and maxillary branches of the fifth nerve is associated with paralysis of one or all of the nerves to the extra ocular muscles.

C. *Anterior cavernous syndrome:* Here the ophthalmic branch of the fifth nerve alone is involved. The third nerve, or all of the nerves to the extra ocular muscles are paretic. In addition to the evidences of cranial nerve compression, the patient may display nonpulsating exophthalmos, with chemosis of the conjunctiva and engorgement of the retinal and conjunctival veins. This occurs if dilatation of the artery produces rapid occlusion of the cavernous sinus, obstructing venous drainage of the orbit. Exophthal-

mos was present in five of the eight cases reported by McKinney[14] and his collaborators.

CASE 3. R. J., (302-038), a thirty-eight year old negress was admitted to the Edward J. Meyer Memorial Hospital on 1-7-'41. Six weeks before she slowly developed left hemicrania radiating from the eye backward. The orbital pain increased progressively. Four days before, she developed complete left ptosis within twenty-four hours. Left vision then began failing and she had transient diplopia. The patient was a known luetic and the Wassermann reaction was positive in the blood but was negative in the spinal fluid.

On examination the patient displayed reduced left visual acuity and concentric contraction of the visual fields. The left pupil was dilated and fixed and the globe was fixed in mid position. Sensation was diminished in the areas of distribution of the first and second divisions of the left trigeminal nerve. Compression of the left carotid artery in the neck relieved the trigeminal pain. Roentgen examination of the skull revealed no abnormalities.

The left carotid artery was compressed manually for gradually increasing periods until the patient could tolerate it for fifteen minutes or more at a time. On 1-28-'41, Dr. W. F. Beswick ligated the left common carotid artery and the left internal jugular vein in the neck, under local anesthesia. Two days later sensation was returning to the anesthetic areas and she felt much improved. On the third day, she developed sudden right flaccid hemiplegia with aphasia. This cleared rapidly, trigeminal function returned, headache disappeared and the ptosis was clearing at the time of discharge from the hospital.

3. *Basal aneurysms with affection of the visual apparatus.* Visual field defects may be produced by compression of the optic nerve, chiasm or tract. The lesion may show no other findings suggestive of aneurysm and thus may be considered a neoplasm. It may be associated with subarachnoid hemorrhage, making differentiation easy. This group of lesions has been admirably discussed by Geoffrey Jefferson[10].

BILATERAL ANEURYSMS OF THE INTERNAL CAROTID ARTERIES

The following case represents a rare clinical type, aneurysms of both internal carotid arteries. Jefferson[10] said that the first English record of an intracranial aneurysm was one of this type, reported by Sir Gilbert Blane[3]. In this historic case, the post mortem examination was done by John Hunter and Holme and witnessed by Blane and Jenner. In 1939, McDonald and Korb[13] found four of these lesions in a series of 1125 cases of intracranial aneurysms recorded in the literature. Two other cases were recorded by Jefferson[11] and Bozzoli[4].

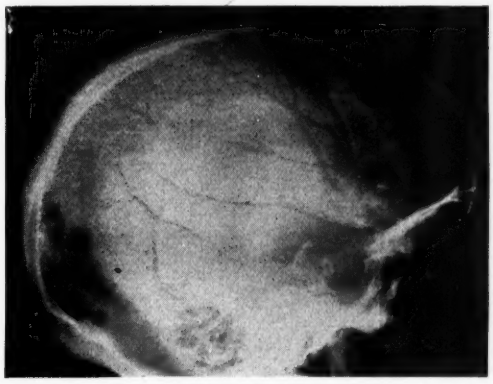

Fig. 3. Case 4. Calcium deposits within the wall of a large carotid aneurysm within the cavernous sinus.

CASE 4. Mrs. B. B., (124-885), a very obese sixty-eight year old widow was admitted to the Buffalo General Hospital on 2-12-'39. Fourteen years before, after a few days of left trigeminal pain, the left eye turned inward and remained so. The pain continued for a year. In June of 1937 the patient had dull frontoparietal headache and within a week the right eye inverted. Right tinnitus began at the same time; within fifteen months the right ear was deaf and tinnitus ceased. In October of 1938 the right eye suddenly inverted more completely. The patient had severe right frontal and temporal headache, emesis and dysphagia.

On examination the scalp was tender in the right temporal area. No bruit was heard. The left eye was inverted so far that none of the pupil could be seen; the right was moderately inverted. Practically complete ophthalmoplegia was present bilaterally. The right optic disc appeared quite normal. The corneal reflexes and other trigeminal functions were intact. The left ear was deaf. The remainder of the neurologic examination gave normal findings.

Roentgen examination of the skull (Fig. 3) revealed a large dome shaped mass with deposits of calcium so arranged as to suggest concentric arcs. The left side of the sella and the petrous tip appeared eroded.

On 2-14-'39 the left temporal region was explored. The temporal lobe was compressed to a thin mantle of tissue overlying a tightly cystic, smooth mass. Needle exploration obtained no fluid, so a short incision was made through the capsule. This revealed concentric layers of dry, friable, translucent, grayish-tan material resembling gelatin, and calcified plaques. The lesion obviously was an aneurysm so the wound was closed. The patient gradually developed right hemiplegia, then pneumonia and expired sixteen days after operation.

Post mortem examination (Fig. 4) revealed a 4 cm. aneurysm of the left internal carotid artery within the cavernous sinus and a 2.5 cm. aneurysm of the right. Both optic nerves were atrophic from pressure of the aneurysms. The branches of the left fifth nerve were tightly adherent to the aneurysmal wall. There was typical pressure atrophy of the basal and medial gyri of both temporal lobes. Both lungs showed grayish hypostatic pneumonia.

Fig. 4. Case 4, Bilateral aneurysms of the internal carotid arteries.

DIAGNOSIS

The signs and symptoms produced by these lesions in various locations have been considered. Although one of our patients was luetic, syphilis is found in no greater percentage of patients suffering intracranial aneurysm than in the general population. If the onset is accompanied by subarachnoid hemorrhage, the nature of the lesion is apparent immediately. If the lesion does not leak, the abrupt onset of symptoms and signs should put one on guard. In some patients the progress may be slow and indistinguishable from that of a neoplasm.

Trigeminal Phenomena. Pressure of cavernous sinus aneurysms of the internal carotid artery upon the trigeminal root, ganglion and branches, usually produces pain that is more or less constant, often with acute exacerbations, usually less severe than that of trigeminal neuralgia. The pain is accompanied by sensory impairment in the domain of the compressed trigeminal division. In one of my cases, the pain was typical of tic douloureux and an injection of the division was made for its relief. The nature of the lesion was not suspected until sellar erosion was demonstrated by roentgenography. It is helpful to compress the carotid artery digitally in these cases; the trigeminal pain due to the pressure of an aneurysm usually is relieved while the aneurysm is obliterated. The application of this simple test is demonstrated in Case 3.

Roentgenography. The roentgen diagnosis of intracranial aneurysm depends upon: (a) opacities in the wall of the lesion, (b) erosions of the contiguous bone, and (c) arteriography.

(a) Rupture and stretching of the normal arterial tunics, with subsequent connective tissue repair often is associated with deposition of calcium salts. These deposits may consist of scattered, small plaques beside the sella or in extensive deposits that allow the whole dome of the lesion to be visualized (Fig. 3). The small scattered plaques may simulate the calcium contained in the walls of craniopharyngiomas, unless they can be lateralized beside the sella. If the lesion has produced visual field defects also suggestive of craniopharyngioma, the difficulty in diagnosis is obvious. Fortunately this coincidence is of rare occurrence. The deposition of sufficient calcium to allow roentgenographic visualization depends upon the age of the lesion.

(b) Erosion of the contiguous bone appears most commonly as destruc-

tion of the sella turcica. While the sellar erosion may simulate that due to pituitary adenomas, this is not often a matter of confusion, although Bozzoli[4] stated that arteriography is the only means of differentiating the etiology of sellar erosion. The erosion due to aneurysm is usually confined to one side of the sella with a tendency toward elevation or destruction of the anterior clinoid process. The tip of the petrous ridge may be eroded as seen in the Towne position. Lesions in the anterior portion of the cavernous sinus frequently erode the sphenoidal fissure and the lower and outer portion of the optic canal.

(c) Cerebral arteriography: The roentgenographic visualization of the intracranial portion of the internal carotid artery and its branches during their injection with contrast media as devised by Moniz[15], offers a means of precise diagnosis of these lesions. Matas[12] hailed its conclusiveness. Dandy[6] raised the question as to whether a negative test would exclude an aneurysm from consideration, since partial thrombosis of the content might prevent the development of the typical picture. Angiography probably will furnish the best clue as to the precise localization and operability of aneurysms of the Circle of Willis.

TREATMENT

Reports[16] concerning survival periods testify that some patients may live for years with various disabilities, but active intervention usually is advisable. The treatment depends upon the location of the lesion. A subclinoid aneurysm within the cavernous sinus usually responds to ligation of the internal carotid artery in the neck. Since sudden occlusion of the artery may result in massive hemispheric ischemia, it is advisable to attempt to promote the development of adequate collateral circulation above the point of occlusion by preliminary graduated digital compression of the artery in the neck. When the patient can tolerate without symptoms occlusion of the artery for fifteen to thirty minutes, it probably is safe to ligate the artery. In some patients who tolerate compression poorly and whose condition precludes long delay, it is safer first to ligate the common carotid artery. This permits reverse flow of blood from the external into the internal carotid to continue cerebral circulation. After further digital compression proves it safe, the internal carotid can be ligated. In one patient[9] with arteriovenous aneurysm, it was possible to ligate both internal carotid arteries without damage to the patient by carrying out these stage ligations. When the lesion projects into the cavernous sinus and leaks into the subarachnoid space, ligation of the artery in the neck will not always be sufficient. Dandy[5] has shown that the internal carotid artery may be closed with a silver clip above the cavernous sinus and below the intracranial branches, "trapping" the aneurysm from the circulation. Werner, Blakemore and King[18] cured a large aneurysm at this site that did not respond to carotid ligation by "wiring" and electro-coagulation.

Leaking intracranial aneurysms that can be localized clinically or by arteriography should be cured surgically if possible, since fatal recurrence is always a sword hanging over the patient's head. Cure may be effected simply by ligation of the internal carotid artery within the neck, as Walsh[17] reported. This may not suffice, however, and visualization of the lesion by craniotomy becomes necessary. If the lesion has a pedicle, this may be occluded with a silver clip, as in Dandy's case[5]. If the lesion is on one of the com-

municating arteries, the vessel may be clipped on each side of the aneurysm, thus occluding it, as Fincher[7] recorded. Before operation one cannot be sure that the carotid is not involved in the lesion and that carotid occlusion will not be necessary, as in our case 2. This makes it advisable to "condition" the circulation by progressive digital compression prior to surgery, so that if carotid occlusion is found necessary it will be less hazardous.

Nonsurgical treatment of unlocalized intracranial aneurysms will not be considered here although reference may be made to the excellent article by Richardson and Hyland[16].

SUMMARY

A résumé is made of the various types of aneurysms of the internal carotid artery and its branches. Proven examples of various types are recorded.

A case of rare bilateral internal carotid artery aneurysm is recorded.

Essentials of diagnosis are outlined.

Treatment consists of isolation of the diseased vessels from the circulation. The means of accomplishing this varies with the location of the lesion. The surgical principles are discussed.

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SUMARIO

Un resumen es hecho de los varios típos de aneurismas de la arteria carótida interna y sus remas. Ejemplos probados de varios típos son mostrados.

Un caso raro de aneurisma bilateral de la arteria carótida interna es mostrado.

Elementos esenciales de diagnóstico son subrallados.

El tratamiento consiste de aislamiento del vaso enfermo de la circulación. Los medios de realizarlo varia con la localización de la lesión. Los principios quirúrgicos son discutidos.

RÉSUMÉ

L'auteur nous présente un résumé des differents types d'anévrismes intéressant l'artère carotide interne et ses tributaires. Des cas sont cités.

Un cas rare d'anévrisme bilateral de l'artère carotide interne est rapporté.

Les signes essentiels du diagnostic sont discutés.

Pour le traitement, il faut isoler la circulation dans les vaisseaux atteints.

Les mesures á prendre sont dictées par le siège de la lésion. Les principes chirurgicaux à employer sont discutés.

United States Chapter, International College of Surgeons Meeting, Denver, Colorado, July 15-July 18. Have you made your reservations?

Lesions of the External Peroneal Nerve

RELIEF BY TRANSPLANTATION

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MOST surgeons are familiar with the ulnar palsy occurring in the hand following some acute injuries at the elbow, and following years after malunited fractures about the elbow. These lesions are relieved by transplantation of the ulnar nerve from its groove behind the elbow into the soft muscle space in front of the medial epicondyle.

Similar lesions occur in the lower extremity over the external peroneal nerve distribution. This nerve is very easily injured because of its superficial course around the head of the fibula. Treatment is difficult if the secondary changes cause continual pressure over the nerve.

Transplantation of this nerve has been done in four cases with relief of all symptoms. Because of the anatomical situation of the nerve, the head, neck and upper one inch of the fibula were excised. The nerve was then transplanted into this defect without tension.

Resection of the upper portion of the fibula permits the peroneal nerve to take a shorter route, thus allowing for the increase in nerve length demanded in the surgical correction of genu valgum.

E. A. Female, White, Age 61.

On 5-24-40 stated that for one and one-half years she had had pain in the left calf of severe type, cramping in nature, aggravated by walking and straightening the leg.

Examination showed a peripheral vascular disease bilaterally, decreased sensation over the peroneal distribution in the left foot, inability to straighten the left knee due to pain. Pressure over the peroneal nerve caused exquisite pain and referred pain to the foot. The calf was atrophied.

On 6-2-40 exploration of the peroneal nerve was done. A chondroma arising from the upper tibio-fibular joint was found projecting posterio-laterally against the peroneal nerve. To remove the tumor completely the head of the fibula was resected. The peroneal nerve was transplanted into this defect. Complete relief of pain was obtained. On 2-20-42 patient had normal extension, flexion to 120 degrees. There was some sub-patellar crepitus in the knee. There was no complaint.

H. K. Female, White, Age 38.

Patient was in an auto accident in December 1939 receiving a fracture of the tibial condyles. There was an old deformity of the leg with hyperesthesia of peroneal distribution in the foot. Pain was constant on walking before the accident.

An open reduction was done with fixation of the tibial condyles by a screw. The peroneal nerve was dissected out and the upper end of the fibula removed. The nerve was transplanted. Peroneal symptoms disappeared. In December 1941 the patient had no complaints. Knee motion showed the greatest angle of flexion to be 185 degrees, and the greatest angle of extension to be 180 degrees.

J. F. Male, White, Age 42.

Patient was first seen on 7-7-40 at which time he states that in 1917 he had been shot in the region of the right fibular head. In 1939 he had an abscess in the region of the right upper leg. After this he developed severe pain radiating from the knee to the foot, of the pin and needle type. This was made worse by walking. Examination showed a fixed equinus of the right foot, flexion deformity of the right knee and hip, weakness of all the dorsiflexors of the right foot. Pressure over the scar near the head of the fibula caused severe pain radiating to the foot. There was hyperesthesia of the outer side of the foot.

On 7-10-40 an operation revealed very extensive varicosities of the peroneal nerve for four inches above the head of the fibula and two inches below. About the head the nerve was so constricted that the size was smaller than normal. The nerve above the constriction was about the size of an adult thumb. The head and neck of the fibula were removed and the nerve was transplanted. The pain was relieved in forty-eight hours.

In December of 1941 patient was still free of pain. He still had the flexion deformity of the hip.

M. M. Male, White, Age 56.

On 11-14-41 patient complained of pain in the left foot and along the outer side of the leg radiating to the knee. This was aggravated by walking. He stated that the fourth and fifth toes were dead and that the outer side of the leg burned continually.

Examination showed a peripheral vascular disease bilaterally, numbness over the entire peroneal distribution, weak dorsiflexors and peroneal muscles. Pressure in the region of the head of the fibula caused

severe pain, similar to the pain of which patient complained.

On 11-19-41 exploration revealed a chondroma of the fabellum present. The nerve showed marked varicosities. The tumor was removed and the head and neck of the fibula resected. The nerve was transplanted. On 12-20-41 there was no return of sensation, but none of the former pain was present.

SUMMARY

The author reports four cases in which transplantation of the peroneal nerve caused immediate cessation of pain.

SUMARIO

El autor reporta quatro casos en los cuales transplantacion del nervio peroneal causa el inmediante cesacion de dolor.

RÉSUMÉ

L'auteur rapporte quatre cas dans lesquels la transplantation du nerf peronéal amena une cessation immédiate de la douleur.

All Fellows, Members, and Associate Members of the International College of Surgeons, as well as the new candidates to be inducted at the Denver meeting, are requested to bring their caps and gowns to the Assembly. These will be worn in the academic procession of the Convention by all except men in uniform, who will not wear caps and gowns.

Observations on Herniated Discs and Hypertrophied Ligamentum Flavum

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THE SURGICAL entities of herniated disc and hypertrophy of the ligamentum flavum have probably received a greater build-up than any other of modern times. The literature of the last five years has been replete with articles regarding these conditions and their treatment.

Historically, it is interesting to know that neurosurgeons have been removing cartilaginous bodies from the spinal canal for many years without recognizing the true nature of these lesions. As far as we can determine Dandy[1] was the first to recognize them, and reported to this effect in 1929. Apparently not too much attention was paid to Dandy's report, and it was not until Mixter and Barr[2] wrote on the subject in 1934 that the profession really directed its attention toward these conditions. Since the time of their report it has rapidly become "open season" on discs all over the country, and whenever such enthusiasm occurs there are bound to be many errors and many untoward results.

Literally thousands of backs have been operated upon for discs in the last seven years, and undoubtedly many of them unnecessarily so, and many of them with poor results.

It is not the purpose of this paper to add another testimonial to the many already occurring in the literature, but rather to point out part of that side of the picture which is too often left untold in medical literature; in other words, the bad side of the picture.

Since so much has been written about how to diagnose these lesions, the problem now ceases to be how to diagnose them, but rather how to keep from diagnosing them. For the sake of completeness, however, some of the cardinal findings should be again emphasized.

A history of recurrent attacks of low-back pain, usually with sciatic radiation, which may or may not respond to conservative measures should lead to the suspicion of such a lesion. If there is a history of a definite back injury anteceding the onset of symptoms, one should be even more suspicious, since approximately 85 per cent of the cases have a definite history of back injury. These patients commonly complain of paresthesias in the extremity, intermittent weakness, relief or aggravation of pain on change of position, and referred pain on coughing and sneezing. They may have any or all of the following cardinal findings present: lumbar muscle spasm, limitation of motion, tenderness over spinous processes, atrophy, diminution or absence of reflexes in the lower extremity, and sensory disturbance which is most apt to be in the calf or the outer side of the foot.

If herniated disc is such a common lesion and one that should warrant surgery being performed on the thousands of cases that have been reported, then it might well occur to the independent thinker to wonder what has happened to all of the hundreds of thousands of people having these discs that have not been operated on in the past generation. In other words, why is the world not full of disc cripples? There can be only

one answer to this, and that is that the majority of the people having these lesions must either have obtained relief spontaneously or by therapeutic measures of a conservative nature. It is my personal opinion that at least 85 per cent of all cases of herniated discs can be relieved by non-surgical measures.

The practice of advising operation immediately on the diagnosis of herniated disc without the employment of all of the various conservative measures is therefore certainly reprehensible. I have seen a number of patients who had all of the cardinal points in their history and all of the points in the examination necessary to make the diagnosis of herniated disc. There is no question in my mind that had I operated on these same cases I would have found a nice, large "juicy" disc and would in all probability have cured the patient. However, I feel that so many of them could be cured without operation that this should never be done until chronicity is established and conservative measures have failed.

Among the conservative measures which should be used, or which should be attempted, are manipulation, casts, extension, braces and other orthopedic procedures including physiotherapy, diathermy, etc.

I have found a very innocuous procedure to be curative in a number of cases, namely, the old and now neglected epidural injection of novocaine and saline. In years past a very commonly used method for the treatment of so-called sciatica was the use of epidural injection, and in most hands relief was obtained in from 50 to 60 per cent of these cases. There is no question whatsoever in my mind but that many of these cases cured by epidural injection actually had herniated discs. I have had several cases that I am absolutely certain had herniated discs, in whom by virtue of the fact that chronicity had not been established, epidural injection was tried and immediate relief obtained. This is perhaps true only in those cases that have not gone many months or years. It should most certainly be tried in early cases, and there is nothing to be lost in trying it in chronic cases.

Let us assume that in spite of all various conservative measures mentioned the patient still continues to have recurring attacks of disability and has developed the cardinal findings of herniated disc. Then, and only then, should surgery be considered.

DIAGNOSIS

When the time has arrived for considering surgery, then the question of positive diagnosis arises. There is only one absolutely certain way of diagnosing and localizing these lesions, and that is by means of intraspinal lipiodol. I shall not go into the various pros and cons of the use of this contrast media except to state that in non-compensation cases there is no valid contra-indication to its use. In compensation cases, however, it should be used only as a last resort because of the various medico-legal aspects which may follow its introduction into the spinal canal.

Air myelography has the advantage of simplicity, and the fact that it leaves no x-ray or other evidence of its use. It has, however, the distinct disadvantage of being a most inaccurate procedure, and it is pretty well agreed that a negative air myelography does not by any means rule out a herniated disc. A positive air is diagnostic, but even here multiple lesions may be missed unless checked by lipiodol.

Is it possible to definitely diagnose and localize a disc clinically? Spurling[3] says it is in the vast majority of cases. Dandy[4] reasons as follows: Since 85 to 90 per cent of all of these lesions are either in the fourth or fifth lumbar interspaces, it is not necessary to use a con-

trast media. Exploration of the fourth and fifth interspaces will disclose 9 out of 10 of the lesions. The only trouble with this reasoning is that one wonders about the other 10 to 15 per cent, where the lesion may be in one of several interspaces. A successful "batting average" of 90 per cent is not too bad, and perhaps this reasoning is valid. In the remaining 10 per cent where the lesion is not discovered, it would become necessary to use lipiodol and a second operation would have to follow after correct localization of the lesion.

My own feeling regarding this question is that in medico-legal or compensation cases, operation could well be performed on the clinical diagnosis without the use of lipiodol, and those cases in which the lesion was not discovered could be checked with lipiodol if they failed to get relief. In this way we would avoid the use of this contrast media in 90 per cent of the cases. In private cases, however, I cannot see that lipiodol offers so many contra-indications as to warrant the exploration of 2 or 3 interspaces or even multiple operations when the operation could be limited to one definite interspace following the use of lipiodol.

Perhaps all of us may some day reach the excellent diagnostic level where we can definitely localize the interspace as Spurling does, and we then can dispense with contrast media entirely.

Herniated and Protruded Discs. There has been very little written regarding the differentiation between herniated and protruded discs. One would judge, therefore, that most authors use the terms interchangeably. In my experience they should be very definitely differentiated since the results in the two conditions are entirely different. I am unable to state how this differentiation can be made clinically. I do feel that it can be made roentgenologically in many cases using lipiodol as a contrast media. My roentgenologic confreres, however, do not agree with this concept. If the defect in the lipiodol column is a sharply punched-out one, I feel very confident that I will find a herniated disc, and always do. When, however, the defect is one in the nature of a rounded V or an hour-glass type of deformity, then I am inclined to believe that I am going to find a protruded rather than a herniated disc. There are several gradations between these two pictures which I am unable to classify, but I feel that at both extremes one should be able to recognize them roentgenologically. The defect produced by ligamentum flavum will be discussed later.

Pathologically I differentiate between herniated and protruded disc as follows: The herniated disc is a true herniation of the nucleus pulposus and the annulus fibrosis into the spinal canal. Many times it is lying free and needs only to be "plucked out." In other cases, when the posterior longitudinal ligament is severed, it extrudes itself almost like tooth paste coming out of a tube. In a few cases it is necessary to curette, but always a definite structure, either in one large, or several smaller pieces, is easily removed. The protruded disc offers an entirely different picture. After cutting the posterior longitudinal ligaments there is no extrusion of the disc, and it is necessary to curette it out and remove it piece-meal. In other words, it is a more or less solid structure having none of the characteristics of the previously described herniated disc.

Where multiple discs are reported, it is my experience that they are practically always protrusions rather than herniations. In my limited experience I have never seen more than one true herniation of a disc in a single case. I have seen a number of multiple lesions

where one has been a true herniation and the others a protrusion.

Not only should these lesions be differentiated clinically and pathologically, but it is my opinion that they have an entirely different etiology. It would seem that a herniated disc is a true herniation as described and is due to injury to the back or to extraordinary strain, or to weakness of the retaining membranes. The protruded disc on the other hand is simply an exaggeration of a normal structure, and might be better called a hypertrophied disc rather than a protruded one. This apparently follows long-continued strain on the ligamentous and disc structures rather than a single or repeated back injury, and it is really a hypertrophied and protective mechanism on the part of nature rather than a herniation. In other words, it must be entirely analagous to the hypertrophied ligamentum flavum which I shall discuss at this time.

Hypertrophied ligamentum flavum. Hypertrophied ligamentum flavum per se is a diagnosis which in my opinion signifies that the underlying pathology has either been misdiagnosed or has not been found. It is sometimes difficult to differentiate between the various lesions, even with lipiodol. I have seen cases in which the hypertrophy of the ligament was so marked, and had extended so far laterally and anteriorly, that I am confident that it would be impossible to differentiate it roentgenologically either from a herniated or protruded disc. When the major deformity is in the anterior aspect it is most apt to be a herniation or protrusion. In the first 50 cases that I operated I found only hypertrophied ligaments and no discs in 9. This is entirely too high a percentage. Of these 9 cases only 2 were such that I felt the ligament was the primary cause of the trouble, and neither of these has had a particularly good result. Out of the last 20 cases in only 2 have I been forced to make this diagnosis.

It is my opinion that hypertrophied ligamentum flavum as a cause of low-back pain and sciatica has been very much overrated. I feel that the hypertrophy indicates underlying pathology; either a disc or the existence of a structural weakness of the back, and the hypertrophy of the ligament is one of Nature's efforts to immobilize the necessary joints. It is, therefore, a protective mechanism rather than a primary pathology. It is true that in some cases the hypertrophy becomes so marked as to compress nerve roots and thus cause symptoms, but there is other pathology present which caused the hypertrophy in the first place.

Protein Determination. The question of the value of total protein determination in the spinal fluid can be answered by stating that if the total protein is elevated to 40 mgms. or more it is confirmatory evidence of the presence of a disc. If it is not elevated it is of no significance, as I have seen any number of huge protrusions without any elevation of total protein. Perhaps this test is subject to laboratory error.

The question frequently arises as to whether this is a neurosurgical or an orthopedic procedure. Since the majority of these cases are now taken care of surgically with the removal of a minimal amount of bone, and in many cases no bone at all, it would seem that any claim of the orthopedic surgeon by virtue of the fact that the operation entails laminectomy is untenable. The important part of the operation is the handling of the nerve overlying the disc which would seem to be a neurosurgical procedure. My chief objection to the orthopedic side of this picture is that the orthopedists seem to feel that fusion is necessary in all cases, which of course it is not.

There are cases in which fusion should

follow removal of the disc. These are the cases where there is a structural weakness of the back, and particularly cases of horizontal sacrum. I feel that where multiple discs are present fusion is indicated, but in single lesions without structural weakness I can see no indication for fusing after the removal of a disc.

SURGICAL TECHNIC

There are four main types of procedure used in dealing with these lesions. The original operation was an extensive laminectomy. This is rarely, if ever, done at the present time. The second type of operation used is hemilaminectomy. This also is not very often necessary. The most common type of operation used at this time, at least by me, is a partial laminectomy to obtain just sufficient exposure to remove the disc without too much difficulty. In the majority of cases it is necessary to remove only a very small portion of the lamina above and below the interspace in order to remove the disc. The spinous processes ordinarily need not be disturbed. Occasionally it is necessary to remove a portion of the spinous process above and below in order to obtain exposure. This type of operation is modified to suit the demands of the individual case and there is no structural weakness of the back as a result.

The operative procedure of choice is removal of the disc without attacking the bone at all. This can be accomplished where the herniation is small and the interspace is large, in which case it is only necessary to remove the ligamentum flavum, retract the nerve and remove the disc. This is the ideal operation and should be attempted in every instance, but ordinarily the previously described type of operation becomes necessary.

It has been my practice to remove the lipiodol in all cases, but Spurling's suggestion of not disturbing the lipiodol because he feels its removal is more dangerous than leaving it sounds very reasonable in the light of some of the experiences I have had, which will be related.

RESULTS OF SURGERY

In reading the reports in the literature one is very apt to come to the conclusion that the picture as far as final results are concerned is a very rosy one. This has not been entirely my experience. In attempting to evaluate the final results of surgery, I have found that it becomes necessary to divide the patients into two groups: first, the private cases, and then the compensation cases, since the results in the two groups are vastly different.

Of the first 50 cases done up to January 1940, 46 are reported at this time. Of these 24 were private cases in whom there was no element of compensation. Twenty-two or 91.7% were sufficiently relieved so that they could be classified as cured. The other 2, or 8.3% were improved, and there were no failures. Interestingly, the two cases that were not classed as cured were both instances where only hypertrophied ligaments were found, an all of the 22 cured cases had definite herniated or protruded discs.

When we consider the 22 compensation cases we have an entirely different picture. In the first place it is extremely difficult to place any kind of value on the results because of the patients' common urge for increased compensation and their unwillingness to admit improvement or cure. I was able with a little straining on our part to classify 7 or 31.8% of these cases as cured. Seven or 31.8% were classified as 50 per cent or more improved, and 8 or 36.4 per cent as failures.

It is obvious in dealing with this type of case that anything less than a practi-

cally complete cure must be classed as unsatisfactory as far as reviewing boards are concerned, and, therefore, roughly I have been able to obtain satisfactory results in one out of three cases operated. This is a very poor "batting average", but is really better than I expected it to be since it has always been my impression that the best that one could hope for in surgery of compensation cases is about one satisfactory result in 4. Even so, this is not a result to be proud of, nor is it one conducive to very much enthusiasm on the part of compensation authorities involved.

In analyzing the 8 failures we found that in 5 of them no disc was found and the diagnosis of hypertrophied ligamentum flavum was made, whereas 6 of the 7 cured cases had definite herniated discs.

Since finding that our results have not been gratifying in compensation cases, I have been making every effort to evaluate the patient's psychology to determine if possible, whether or not he is a patient in whom one could hope for a good result. Many of them are obviously cases whose chief desire is compensation, and in these cases it is a waste of time to even make the effort to arrive at a proper diagnosis.

UNTOWARD RESULTS

We leave the saddest part of the picture for the last. I personally have had four cases in which the ultimate outcome has been extremely bad in that the patients have either not only not been benefited, but made worse, or have residual disabilities as a result of the operation.

I have seen no similar reports in the literature regarding bad results, and I must, therefore, take it for granted that either I am the only one who has had such results, or that I am the only one with sufficient temerity to cite them. One was a patient in whom, after removal of a so-called hypertrophied ligamentum flavum and a small disc, and after a short interval of relief of symptoms, fell backwards and there was a recurrence of all of the previous complaints. After many months of various treatments a repeat lipiodol examination was made, and a complete block was found at the second interspace, whereas the previous operation had been at the fourth. A diagnosis of a recurrent herniated disc was made. At exploration the block was found to be due to an extensive adhesive arachnoiditis which had congealed all of the nerve roots of the cauda equina together into a very firm mass. This man is a total disability, and the only explanation of this result that I have to offer is that he did have a postoperative wound infection which probably caused the adhesive arachnoiditis.

In another case showing a complete block with lipiodol, instead of a herniated disc, an adhesive arachnoiditis of the cauda equina with hypertrophied ligamentum flavum was discovered at operation. This man was not only unrelieved, but developed incontinence of the bladder as a result of the operation.

While it is true that these were among my early cases, and the diagnosis incorrect in both instances, they must be cited as bad results of this type of surgery.

A rather recent case not included in the statistics was operated twice and at neither operation was a herniated disc found in spite of x-ray deformities with lipiodol. At the second operation only a tremendously hypertrophied fifth lumbar root was found, and in spite of rhizotomy of the sensory portions of the nerve root, this patient continues to have all of her previous symptoms in an aggravated degree. The pathology, whatever it may be, still remains a mystery.

The fourth case was one in which it was necessary to remove a tremendous

herniated disc transdurally, and apparently retraction of the nerve roots laterally in the course of removing the disc was too strenuous, as he developed a postoperative foot drop. While this man had been relieved of his pain and the disability resulting from his pain, he now has the disability of a foot drop. Sufficient time has elapsed for me to believe it will be permanent.

It would seem that this paper has been largely in the nature of criticism of all of this work, but it is written for the purpose of calling attention to the fact that the picture is all not as clear and simple as it might seem from a perusal of the literature.

After taking the things I have said into consideration, it is still undoubtedly true that if the cases are properly selected, properly diagnosed, and properly operated, the results in the majority of cases are extremely good. I know of no more grateful patients than those who have been periodically disabled by virtue of a herniated disc who have been cured by its removal. If we apply conservative measures and are conservative in our selection of cases, there is no reason why this should not continue to be and become an ever more brilliant field of surgical endeavor.

SUMMARY

1. The results in the majority of properly selected and diagnosed, efficiently operated cases of herniated discs are good.

2. The author believes that 85 per cent of all cases can be relieved by non-surgical measures and that conservative measures (manipulation, casts, and other orthopedic procedures) should be attempted before surgery is invoked.

3. The operation of choice is removal of the herniated disc without attacking the bone. This should be attempted in every case, to be followed, if necessary, by the removal of a portion of the lamina above and below the interspace.

The practice of fusing these cases so commonly followed by orthopedic surgeons is not warranted. Fusion is necessary in not over 10% of cases: those in which bony abnormalities such as horizontal sacrum are present.

4. In 24 private cases, 22 (91.7 per cent) were sufficiently relieved to be classified as cured; the other 2 (8.3 per cent) were improved. There were no failures. In 22 compensation cases, however, 7 (31.8 per cent) were classified as cured; 7 (31.8 per cent) as fifty per cent or more improved, and 8 (36.4) per cent) as failures. It is thus important to evaluate the patient's psychology: if his chief desire is to obtain compensation, then it is a waste of the surgeon's time even to try to arrive at a proper diagnosis.

5. Four cases in which the results following operation were not satisfactory are discussed.

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SUMMARIO

1. Los resultados en la mayoria de los propiamente seleccionados y diagnosticados, casos eficientemente operados de discos herniados son buenos.

2. El autor cree que el 85 por ciento de todos los casos pueden ser mejorados por medídas no quirúrgicas y que medidas conservativas (manipulaciones, aparatos de yeso, y otro procedimientos ortopedicos) deben de ser atentados antes de que la cirugía sea invocada.

3. La operación a escojer es la extirpación del disco herniado sin atacar el hueso. Esto debe ser atentado en cada caso, y seguirlo, con la extirpacion

de la porción de lámina arriba y abajo del interespacio. La practica de fusión en éstos casos, tan comunmente seguida por cirujános ortopédicos, no es aconsejada. Fusión es necesaria en no mas del 10% de los casos; esos en los cuales anomalia de los huesos es presente tales como sacro horizontal.

4. En 24 casos privados, 22 (91.7 por ciento) fueron suficientemente aliviados para ser considerados como curados; los otros 2 (8.3 por ciento) fueron mejorados. No hubieron fracasos. En 22 casos de compensación (seguro), 7 (31.8 por ciento) fueron clasificados como curados; 7 (31.8 por ciento) como cincuenta por ciento o mas mejorados, y 8 (36.8 por ciento) como fracasos. Es por lo tanto importante evaluar la psicología del paciente, si su deseo principal es el obtener compensación, siendo por lo tanto una perdida de tiempo para el cirujáno tratar de llegar a una conclución propia de diagnóstico.

5. Cuatro casos en los cuales los resultados siguiendo la operación no fueron satisfactorios como discutidos.

RÉSUMÉ

1. Dans la majorité des cas bien choisis bein diagnostiqués, et bien opérés de disques intervertébraux herniés, les résultats sont bons.

2. L'auteur avance l'opinion que quatre-vingt-cinq de tous les cas peuvent être soulagés par des mesures non-opératoires, et il ajoute que les moyens conservateurs (manipulation, plâtres et autres procédures orthopédiques) doivent être employés avent d'avoir recours à la chirurgie.

3. L'opération de choix est l'enlèvement du disque hernié sans infliger de lésions à l'os. Ceci sera fait dans tous les cas; s'il est nécessaire on enlèvera une portion de la lame audessus et audessous de l'intervalle. La fusion, ordinairement recommandée par les chirurgiens orthopédiques, ne sera pratiquée que rarement. La fusion n'est indiquée que dans moins de dix pour-cents des cas: in presences d'anomalies osseuses tel qu'un sacrum horizontal, etc.

4. Dans vingt-quatre cas personnels, 22 (91.7 pour cent) furent soulagés de tetle facon que nous les considerous guéris, les deux autres montrèrent une amélioration. Iln'y eut aucun insuccès. Dans 22 cas d'accidents du travail, 7 (31.8%) furent guéris; 7 (31.8%) montrèrent une amélioration de 50 pour cent ou plus et dans huit cas (36.4%) les malades n'accusèrent aucune amélioration. Il importe d'évaluer la psychologie du malade: sa principale préoccupation est d'obtenir une compensation. Cela rend difficile et la tâche du chirurgien, et un diagnostic précis.

5. Quatre cas qui aprés l'opération donnèrent des resultats peu satisfaisants sont analysés en detail.

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Surgical Aspects of Prefrontal Lobotomy*

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PREFRONTAL lobotomy has been performed in 131 patients with mental disorders. Thorium dioxide or lipiodol has been injected at operation and the depth and the extent of the incisions in the frontal lobe have been verified by roentgenograms in nearly all cases. The best results occur when the lobotomy is made in the plane of the coronal suture. When the frontal lobe is incised too far anteriorly, there is but temporary or no relief from distressing mental symptoms. When the incisions are made too far posteriorly in the prefrontal region, there is profound inertia, dullness and disorientation with masking of the facies and vesical incontinence which later goes over into a state of bland and euphoric indifference. Equally important as the plane of the incisions are the depth and extent of the incisions in the frontal lobes. Prefrontal lobotomy may be performed in the plane of the coronal suture, but if insufficient white matter is cut, then worry, nervous tension, apprehension and obsessive thinking are not permanently relieved. The operation must be done on both sides symmetrically.

It is our opinion that the profound emotional alterations in the absence of any serious intellectual deficit are the result of section of fibers connecting the prefrontal region with the thalamus, that is, the thalamo-frontal pathway. Anatomic study of three cases revealed almost isolated degeneration of the nucleus medialis dorsalis of the thalamus.

This paper will be limited to the surgical aspects of prefrontal lobotomy. A complete discussion of the subject and the evidence for the statements made here are contained in our monograph entitled, "Psychosurgery — Intelligence, Emotion and Social Behavior following Prefrontal Lobotomy for Mental Disorders."

Written permission for operation is obtained from the patient and from the nearest relative in nearly all cases. When patients are so disturbed that they are unable to sign, written permission for operation is obtained from the nearest relative, and in some instances from the two nearest relatives. It is important to tell the relatives what they may expect following operation. They are informed that the patient is usually drowsy, unresponsive and disoriented for several days. Approximately half of the patients have vesical incontinence which usually clears up before they leave the hospital but which may last longer. They are told the operative mortality, the incidence of hemiplegia and the incidence of convulsive attacks which are known to develop. No patient is accepted for operation unless the family can arrange to look after him during the period of readjustment following discharge from the hospital.

Local anesthesia is used in about half the cases. Patients with agitated depression and uncooperative schizophrenics are operated upon under avertin. It is often necessary to anesthetize such

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patients before shaving the head. Only frontal and temporal regions are shaved.

In 1936 a bilateral operation upon the frontal lobes was proposed by Egas Moniz for the treatment of certain mental disorders. He considered the symptoms in the functional psychoses due to the development of stereotyped patterns in cortical association centers and thought that by forcibly breaking up the connections over a large area an opportunity would be given for reintegration of cortical activity along different lines. He first injected small amounts of alcohol into the white matter of the prefrontal region but soon substituted the leucotome which was found to be more precise.

THE MONIZ TECHNIC

The Moniz technic was employed in our first twenty cases. Six spherical cuts or cores were made in the upper part of the prefrontal area of each frontal lobe. Thorotrast was injected in some of our patients to visualize the cores. Although there was immediate remission of symptoms in the majority of cases, within a few months many relapses had occurred. It was noted that patients who were alert, well oriented and euphoric for a few days after operation usually relapsed, while those who were unresponsive, drowsy and disoriented usually secured satisfactory clinical results.

We changed the technic, and instead of making six spherical cuts in the upper part of each frontal lobe, made nine spherical cuts in the lower part of each frontal lobe. The cuts were made with the leucotome through the burr hole in the same location 3 cm. lateral to the midline, 3 cm. anterior to the interaural line. Cores in the lower part of the frontal lobe produced a higher incidence of good results than cores placed in the upper part of the frontal lobe. Disadvantages of this method soon became apparent. When the leucotome is inserted into the frontal lobe from above to a depth of 8 or 9 cm., a slight increase in angulation forward will place the lesion too near the frontal pole and will not relieve the symptoms. If the instrument is angled insufficiently forward, it may enter the anterior perforated space or the temporal lobe and tear penetrating branches from the anterior or middle cerebral arteries. This happened twice with fatal results. Motor pathways were damaged in one patient. With increased experience it was found that better results are obtained when a larger proportion of the white matter is cut. In order to overcome the objections to the Moniz method, the technic which is now being used was devised.

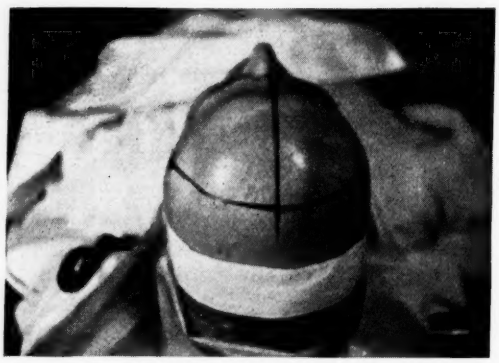

Figure 1. The coronal suture is outlined on the scalp. It crosses the midline 13 cm. from the glabella. Rubber tissue is attached to the scalp with adhesive to keep blood from leaking into the hair.

OPERATIVE PROCEDURE

Prefrontal lobotomy consists in cutting the white matter of each frontal lobe in the plane of the coronal suture. This plane passes just anterior to the tip of the frontal horn of the ventricle. The operation is carried out through a burr hole 1.5 cm. in diameter over the lateral aspect of the frontal lobe about 2.5 cm. above the floor of the frontal fossa.

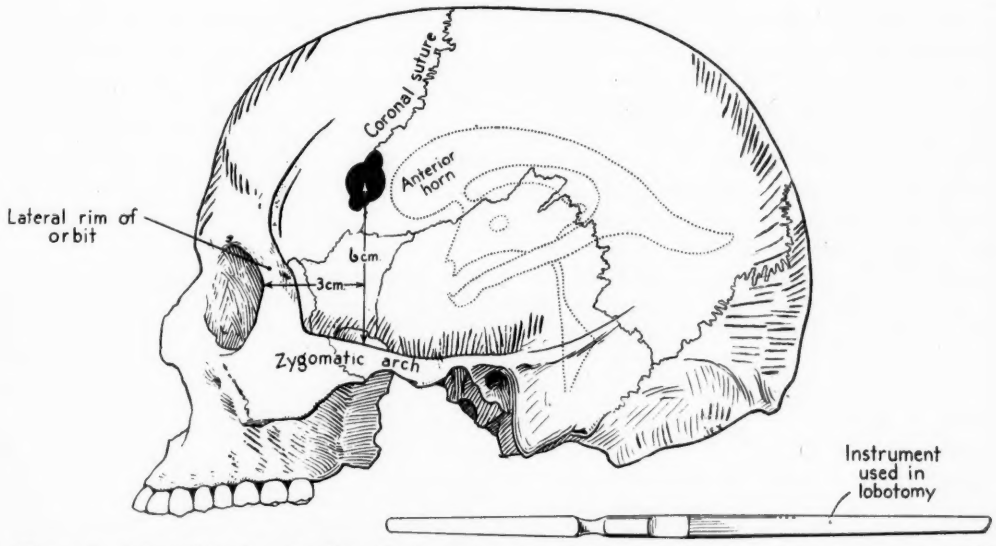

Figure 2. A burr hole is made through the lower part of the coronal suture using the measurements shown in the drawing. The hole is enlarged by taking a bite with the rongeur to allow more space to swing the blunt dissector. (After Freeman and Watts, 1942.)

From an examination of numerous skulls it has been found that the coronal suture crosses the longitudinal sinus approximately 13 cm. from the glabella. If the skull is unusual in shape or size, the site at which the coronal suture crosses the midline can be verified by making a small incision adjacent to the midline. The lower part of the coronal suture is located at a point 3 cm. posterior to the lateral rim of the orbit (anterior margin) and 6 cm. above the zygomatic process. This point approximates the lower end of the coronal suture where it meets the greater wing of the sphenoid bone. If the exposure is too low down, the burr hole may be faultily placed over the fronto-sphenoidal or temporo-sphenoidal suture. The approximate location of the coronal suture is now outlined on the scalp with gentian violet (Figure 1).

An incision 3 cm. long is made in the plane of the coronal suture, the center of the incision being 6 cm. above the zygomatic process. The incision is carried down through the skin and the temporal muscle. With hammer and chisel an impression is made in the bone at the cross-mark, thus marking the level in the vertical plane. With periosteal elevator the muscle is scraped back and the coronal suture is identified (Figure 2). The muscle and skin are retracted with a mastoid self-retaining retractor. A burr hole is made through the suture line 1.5 cm. in diameter, then the dura is incised crucially. A small bite is taken above and below with a rongeur in order to enlarge the opening. After hemostasis, an incision 2 to 3 mm. long is made through an avascular area in the cortex. A similar procedure is carried out on the opposite side. A brain cannula (we use the Watts-Freeman leucotome, which is about 15 cm. long) is inserted into the frontal lobe with the point directed at the burr hole on the opposite side (Figure 3). The instrument usually passes just anterior to the tip of the frontal horn of the ventricle and slightly posterior to the free margin of the falx

cerebri. In this plane the median longitudinal fissure is an average distance of 5.5 to 6 cm. from the surface of the frontal lobe. One readily recognizes the falx cerebri, but when posterior to the falx one is not always aware that the median longitudinal plane has been crossed because the instrument may pass through the genu of the corpus callosum. If the surgeon is not sure of the distance from the cortex to the median longitudinal plane, the cannula is inserted toward the falx cerebri where it crosses the coronal suture. If the ventricle is entered, the cannula is withdrawn and the point directed slightly anteriorly so that it will pass in front of the ventricle.

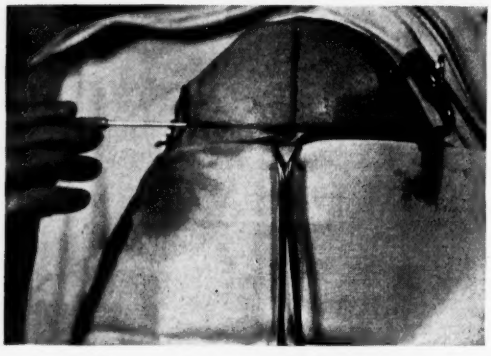

Figure 3. A brain cannula is inserted into the frontal lobe with the point directed at the burr hole on the opposite side to locate median longitudinal plane and ventricle.

The sphenoidal ridge is located by directing the cannula at an angle of 45° toward the base of the skull, always keeping it in the plane of the coronal suture (Figure 4). The sphenoidal ridge is encountered at a depth 4 to 5 cm. If the cannula, when angulated downward in this way, penetrates to a depth of more than 5 cm., the tip has probably slipped posterior to the sphenoidal ridge and has entered the middle fossa. It should be withdrawn, angled forward and reinserted. Now one knows the location of the tip of the lateral ventricle, the sphenoidal ridge, the median longitudinal fissure and 3 points on the coronal suture. All the necessary information is available to incise the frontal lobe in the plane of the coronal suture anterior to the tip of the ventricle.

Figure 4. The sphenoidal ridge is located by directing the cannula at an angle of 45° toward the base of the skull, always keeping in the plane of the coronal suture.

A blunt dissector (we use Killian's periosteal elevator, illustrated in Figure 2), is inserted into the frontal lobe along the track made by the cannula to

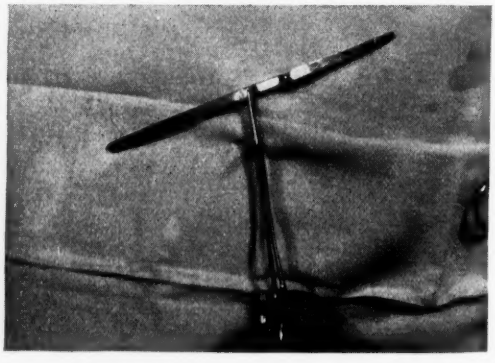

Figure 5. In order to maintain the blade of the dissector always in the plane of the coronal suture, a hemostat is clamped to the handle at a right angle. The dissector is graduated in centimeters.

a depth of 5 cm. This will avoid the gray matter on the medial surface of the frontal lobe and reduce the danger of lacerating blood vessels. It is dangerous to approach too closely to the midline since the anterior cerebral artery may be traumatized. In order to maintain the blade of the dissector always in the plane of the coronal suture, a hemostat is clamped to the handle at a right angle (Figure 5). The neurologist sits behind the patient's head with his eyes in the extended plane of the coronal suture. (If the neurologist is not available, the first assistant drops out and assumes his duties.) As the surgeon commences the subcortical incision, the neurologist guides both the dissector and hemostat in the same plane throughout the course of the incision (Figure 6). With the surface of the brain as the axis, the point of the instrument is swung downward until the floor of the frontal fossa is touched. The point of the instrument is gently drawn along the floor of the frontal fossa, cutting white matter in the lower part of the frontal lobe down to the base as far laterally as permitted by the small opening in the skull. The importance of keeping in the frontal fossa, thus avoiding the anterior perforated space and the temporal lobe, cannot be too strongly emphasized. Always cut from the center toward the periphery, as shown in Figure 8.

Often as one begins to cut the lower quadrant, resistance is encountered. Twice resistance was felt, then there was a "give," followed immediately by profuse hemorrhage through the incision in the cortex. Once the anterior cerebral artery was torn. When this happens it is necessary to enlarge the opening in the bone, incise the cortex, pack the lobotomy with cottonoid and, with the use of a lighted retractor, locate the bleeding point. The opposite ventricle is tapped to control pressure until the opening in the bone and cortex can be enlarged. No patient has been lost due to hemorrhage at the time of operation. Hemiparesis has occurred five times, but cleared up in all except the one in which the anterior cerebral artery was damaged. Now when resistance is encountered the blunt dissector is withdrawn 0.5 or 1.0 cm. until the white matter can be cut without fear of lacerating a vessel. Now this resistant white matter which we failed to section is partly cut by making several stabs into it with a slightly wider blunt dissector.

After each incision is made in the frontal lobe, it is irrigated with saline solution until the returning fluid is clear. Bleeding usually amounts to only a few drops, although it may amount to 2 or 3 cc. The incision made in the lower part of the right frontal lobe is referred to as the right lower cut or as cutting the right lower quadrant. The white matter in the lower part of the opposite frontal lobe is cut in like manner.

The white matter is now sectioned in the upper part of the frontal lobe. The blunt dissector is inserted through the same opening in the cortex to a depth of 5 cm. with the point directed at the burr hole on the opposite side. With the surface of the brain as the center of a circle, the point of the instrument is swung upward as far as the opening in the skull will permit, care always being taken to keep in the plane of the coronal suture. The white matter is thus cut in the upper and lower parts of both frontal lobes, or, stated in another way, it is cut in all four quadrants.

After the incisions in the frontal lobes have been completed and the irrigating fluid returns clear, a few drops of lipiodol are injected so that the exact location of the lobotomy can be determined (Figure 7). It is only by visualizing the depth and extent of the incisions that one can determine the cause of failure to

relieve the patients' symptoms. Nineteen patients in whom prefrontal lobotomy failed to relieve symptoms, have been operated upon a second time and four have required a third before relief could

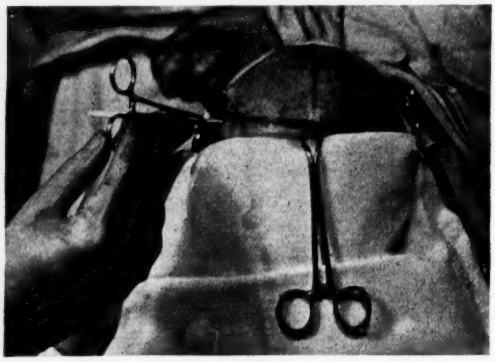

Figure 6. As the surgeon commences the subcortical incision, the neurologist guides both the dissector and hemostat in the same plane throughout the course of the incision. The photograph shows the left upper quadrant being cut. When the left lower quadrant is cut, the hemostat is placed on the opposite side, the dissector is held in the right hand and the hemostat in the left hand.

be obtained. In these nineteen patients there has been persistent relief of mental symptoms in all but two cases. Usually the second operation is performed through the same burr hole, the incisions being directed toward the medial fibers. In several instances, however, it was thought better to make new holes through the coronal suture 3.5 cm. from the midline and thus section more completely the fibers in the upper quadrants. Following this procedure there is always more profound inertia and incontinence. In the most stubborn cases the new burr holes have been placed 1.5 cm. posterior to the coronal suture. The incisions in the scalp are closed with layers of interrupted black silk sutures in the temporal muscle, in the galea, and in the skin.

The technic has been fairly well standardized, but this is not sufficient in every case. Having observed repeatedly that a satisfactory therapeutic result occurs only when lobotomy produces drowsiness and disorientation, these symptoms are now used as a yardstick to determine the extent and depth of the incision, when the patient is being operated upon under local anesthesia. Nervous tension often disappears after two or three quadrants are cut, but the patients can still repeat the Lord's Prayer, define the difference between a king and a president, multiply and divide. After the fourth quadrant is cut, he usually becomes drowsy, confused and disoriented within a few minutes (Figure 8). If these symptoms fail to occur, additional pathways are cut, usually by extending the incision closer to the midline.

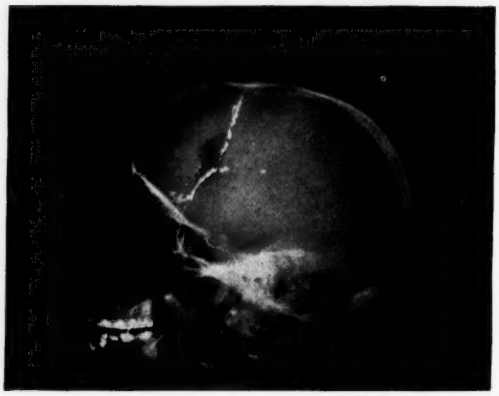

Figure 7. After the incisions in the frontal lobes have been completed, 0.5 cc. of lipiodol is injected so that the exact location of the lobotomy can be determined. This lobotomy was made more extensive than usual, because the patient was a disturbed schizophrenic. The right lower cut angulates a little forward to avoid entering the middle fossa in this case.

There is very little shock associated with prefrontal lobotomy as shown by records of the blood pressure, pulse and respiration. The pulse is usually slower at the conclusion of the operation than at the beginning, most probably due to

the relief of nervous tension. The blood pressure changes very little except in patients with hypertension where a great reduction sometimes is observed.

POSTOPERATIVE CARE

From the operating room the patient is taken directly to the x-ray room, if his condition justifies the manipulation which is required. A posterior anterior view and a stereoscopic lateral view of the skull are taken to verify the exact location of the lobotomy, the central beam being focused as nearly as possible over the two burr holes. The patient can usually cooperate fairly well.

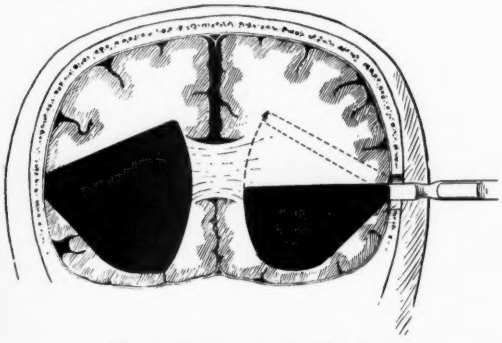

Figure 8. Nervous tension is reduced after three quadrants are cut, but the patient can still say the Lord's Prayer, define the difference between a king and a president. After the fourth quadrant is cut, he usually becomes drowsy, confused and disoriented. (After Freeman and Watts, 1942.)

The patients are put to bed in semi-Fowler position, with the head of the bed elevated at an angle of 30°. This reduces venous congestion, improves the venous return from the brain and is thought to prevent postoperative hemorrhage. The head is kept elevated continuously for 72 hours. If the blood pressure falls below 100 mm. systolic, the bed is flattened until the pressure returns to 100 mm., when it is again elevated.

The blood pressure, pulse and respiration are recorded every hour for 24 hours, then every two hours for an additional 48 hours. Rectal temperature is taken at two-hourly intervals for 24 hours and every four hours thereafter. It is desirable to have a special nurse with the patient continuously for at least 24 hours after operation. The patients are usually confused and disoriented. They frequently do not realize that they have been operated upon, and if not carefully watched, will get out of bed and wander to the toilet. While this has happened to several patients without harmful effects, it is not encouraged. Another reason for having a nurse in attendance is that it may require a day or two to determine whether the patients are still suicidal risks, and a nurse is necessary for their protection and the protection of the hospital. Elderly patients who are drowsy and unresponsive are turned in bed every two hours to prevent pulmonary congestion.

Vomiting often occurs on the operating table after the white matter is cut, particularly when local anesthesia is used. Vomiting may occur several times, then cease spontaneously. Occasionally vomiting persists for one to three days, and when it does 500 cc. of 5% glucose in normal saline is given intravenously at 6 to 12 hour intervals. Fluids by mouth are started after nausea disappears but are limited to 1,000 cc. in 24 hours for three or four days, when the normal fluid intake is resumed. A soft diet is usually started on the first or second postoperative day.

There is relatively little pain following lobotomy. Codein gr. 1 is usually sufficient to control pain. It is rarely necessary oftener than at four-hourly intervals, and many patients do not require it more than once or twice. An enema is given on the second postoperative day, and the sutures are removed on the third or fourth postoperative day.

It has been noted repeatedly that

drowsiness and confusion are more prominent on the second, third and fourth postoperative days than they are the day of operation. The exacerbation of symptoms several days after lobotomy is attributed to edema in the neighborhood of the incisions in the frontal lobe. Some patients who are alert and well oriented the evening of operation become somewhat confused a day or two later. Drowsiness, confusion and disorientation begin to clear up between the fifth and the tenth postoperative days. Hemorrhage is not to be confused with edema, as it occurs at a different time and presents a different clinical picture.

There have been three cases of hemorrhage into the substance of the brain which came on suddenly within a few hours following operation, and all three patients died. All were over 60 years of age. In the two cases which came to autopsy, hemorrhage was caused by injury to branches of the middle cerebral artery passing through the anterior perforated space. It is doubtful if anything could have been accomplished by an open operation designed to wash out the hemorrhage, but it is clear that arteries passing through the anterior space should be avoided, and this can be done by keeping in the plane of the coronal suture.

As the operative technic has been developed, the results of prefrontal lobotomy have improved and the complications have been reduced. There have been three operative deaths in the 131 patients and all occurred in the first half of the series; four have died subsequently. Fifty-one lobotomies are too recent to evaluate the results.

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The first 80 patients fell into the following categories: 38 involutional depressions, 18 obsessive tension states, 12 schizophrenias, 8 psychoneuroses, 4 undifferentiated. We consider the results good in 50, fair in 16 and poor in 11. The best results have been obtained in involutional depressions and obsessive tension states. Twenty patients are regularly employed, 7 are studying or partially employed, 22 are housekeeping, 18 are at home, 6 are in institutions and 7 are dead.

SUMMARY

The operative technic of prefrontal lobotomy is described, and the preoperative and postoperative care are outlined.

One hundred thirty-one patients have been operated upon but fifty-one are too recent to evaluate. Of the first eighty patients, the results are considered good in fifty. There have been three operative deaths.

The profound emotional alterations in the absence of any serious intellectual deficit are attributed to cutting the pathways connecting the prefrontal region with the thalamus.

SUMARIO

La técnica operatoria de lobulectomia pre-frontal es descrita, y los cuidados pre y postoperatorios son señalados.

Ciento triente y uno pacientes han sido operados, pero cincuenta y uno son muy recientes para evaluar. De los primeros ochenta pacientes, los resultados son considerados buenos en cincuenta. Ha habido tres muertes operatorias.

La alteración emocional profunda en la ausencia de algunos défices intelectuales serios son atribuidos al corte de la porción conectando la región prefrontal con el talamus.

Subdural Hematoma

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ALTHOUGH subdural hematoma has been encountered for more than 300 years, its frequent recognition as a clinical entity has been limited to the last 10 or 15 years. The earliest recorded hematomas were of the acute variety and were recognized to be the result of cranio-cerebral trauma. After the development of pathology, numerous subdural hematomas were found in which there appeared to have been no antecedent trauma. Such instances led to speculation concerning the mechanism of hematoma formation. Heschl[1] and Cruveilhier[2] believed that an inflammatory membrane preceded the hemorrhage, while Baillarger[3] and Prescott Hewett[4] reported cases in which there was good reason for believing the membrane was the result of the effusion of blood.

Virchow's[5,6] opinions for a long time dominated ideas concerning subdural hematoma. His paper published in 1857 was the first which gave a clear description of the histology of the membrane. Although Virchow recognized the fact that subdural hematoma might occur from trauma to large blood vessels or spontaneously in hemorrhagic, vascular, or valvular disease, or might burst through the pia from the cerebral cortex, he did not believe that a hematoma of such origin would reproduce the appearance or behavior of the "spontaneous" hematoma. He believed that in certain patients, especially the insane, the dura became chronically inflamed and was covered with a thin exudation of fibrin, sometimes tinged with blood on its inner surface. Capillaries grew into the membrane from the dura and, if the conditions of formation repeated themselves, another layer of fibrin might form and become organized. The tissue might become extremely vascular, with large, thin-walled, and tortuous blood vessels. Virchow believed these vessels might rupture and cause hemorrhages of varying size and that repeated hemorrhages might occur. He termed the fibrinous exudation and its organization pachymeningitis interna chronica, while if extravasation of blood was a prominent feature the condition was designated as pachymeningitis interna hemorrhagica. He called the bloody sacs or cysts hematomas of the dura and recognized that the contents of the sacs might be replaced by serous fluid. He believed small extravasations might regress but the large ones were almost invariably fatal.

Kremiansky[7] in 1868, analyzing clinical histories, found that subdural hematoma occurred in patients with many kinds of infectious diseases, especially rheumatism and typhoid fever. In all cases there was a history of chronic alcoholism, and he considered this the fundamental etiological agent. In three of four dogs to whom he administered brandy daily for two or three months he found pachymeningitis at autopsy.

Huguenin[8] recognized the possibility of trauma as an etiological factor and referred to several cases, some of which were original, in which the condition

seemed due to trauma. He encountered a significant proportion of cases in patients with hemorrhagic diseases and heart disease.

Wigglesworth[9] laid emphasis on the frequency in which fresh fluid blood was found without a membrane beneath the dura in the insane; this occurred in one-sixth of his cases. He argued that the membrane could not be the only source of the hemorrhage, and that the reverse was probably true. He explained the hemorrhage by rupture of a pial vein into the subdural space.

In 1914, Wilfred Trotter[10] published an excellent article on subdural hematoma. He emphasized the traumatic origin of the condition, described the clinical picture most commonly encountered, and stressed the fact that the lesion was frequently bilateral. Two of his four cases, in each of which bilateral subdural hematoma existed, died. In neither case was operation upon the second side attempted until some time after the original procedure. Trotter removed the membranes and their contents through small bone flaps although he appears to have recognized that the fundamental objective was the evacuation of the sac. His article, perhaps on account of its appearance at the start of the first World War, did not at the time receive the recognition which it deserved.

In 1925 Putnam and Cushing[11] published an article of great importance in drawing attention to this condition. Reports of the six cases, which at the time comprised Cushing's experience with subdural hematoma, and six additional cases contributed by three members of the Society of Neurological Surgeons were given. The traumatic etiology and the pathological and clinical aspects of the condition were fully considered, as well as the operative treatment.

In 1932, Gardner[12] published experimental data suggesting that the latent interval from the time of trauma until symptoms began was best explained by presuming that the membrane of the hematoma acted as a semi-permeable membrane through which fluid from the subarachnoid space passed to dilute the protein rich fluid inside the sac. This would produce a consequent increase in the volume of the hematoma sac which finally would reach a size where it could no longer be accommodated inside the intracranial cavity without symptoms. Prior to this time it had been generally believed that repeated hemorrhages into the sac occurred and this was assumed to be the explanation for the late onset of symptoms. Gardner was unable to produce true subdural hematomas experimentally in animals. He implanted cellophane sacs containing whole blood in the subdural space and observed an increase in their volume with the passage of time. He also showed by use of a hematoma membrane that dialysis through the membrane could occur in vitro.

In 1932, Fleming and Jones[13] reported nine cases in which hematomas had merely been evacuated through trephine openings and no effort had been made to remove the membrane. Although this treatment had been employed previously, it was reserved for patients who appeared moribund. Prior to that time removal of the membranes and their contents was considered desirable and necessary. There was but one death in the series reported by Fleming and Jones; this was a considerable improvement on the results generally obtained at that time. They recommended that fluid hematomas be treated by evacuation of the contents of the sac, and that osteoplastic craniotomy and removal of the membranes be reserved for the rarely encountered solid hematomas. Subsequently this method of management has been generally adopted and there has

been a marked reduction in the post-operative mortality.

Subdural hematoma occurs at all ages, but is most common in healthy adult males as trauma is more common in this group. In most instances the condition is not severe enough to be associated with prolonged unconsciousness or fracture of the skull. In many instances the injury is so trivial that no significance is attached to it by the patient and it may have been forgotten. In some patients apparently no cranio-cerebral injury has been sustained, and in these the hematoma appears to be truly spontaneous. In these instances some hemorrhagic diathesis, such as subclinical scurvy or purpura hemorrhagica, is usually present. Bleeding into the subdural space is believed to be usually the result of injury to a vein passing from the cerebral cortex through the subdural space to enter the superior saggital sinus although at times the damage is to other veins. Trotter[10] suggested that blows to the head in an anterior or posterior direction were more likely to cause such bleeding. He believed that the falx was in such instances unable to prevent movement of the brain as well as it might with laterally placed blows. A subdural hematoma is usually of wide extent as no anatomical barriers exist in the subdural space to prevent the spread of blood. Hematomas are bilateral in 20-30% of the cases. The hematoma is usually 1 to 3 cm. thick, being somewhat lens shaped and tapering to its edges. The medial edge of the hematoma is usually close to the superior saggital sinus, and the antero-posterior diameter is usually greater than the vertical diameter. While the hematoma may cover much of the convexity of the hemisphere, it rarely extends below the Sylvian fissure. Munro and Merritt,[14] who studied a large series of hematomas, found that blood present in the subdural space for 24 hours was surrounded by a thin layer of fibrin. Fibroblasts arose from the junction of the dura and clot, and with the passage of time the membrane in contact with the dura became progressively thicker and large thin-walled vascular channels appeared; the portion of the membrane in contact with the pia arachnoid at all times remained thin and transparent. The hematoma can at all times be readily separated from the inner surface of the dura, and there is never any adherence of the hematoma to the pia arachnoid. Soon after its extravasation the blood inside the hematoma begins to break down. As the protein molecules break down into smaller molecules, the osmotic pressure inside the hematoma sac increases and fluid is attracted into the sac. Munro and Merritt suggested that a period of three to four months was required for the blood to break down completely. The longer the hematoma exists, the thicker the external layer of the membrane becomes, and the thinner and more yellow-appearing the fluid contained in the sac becomes. Although the role of osmosis in the increasing size of the lesion is denied by some,[15] this explanation is generally accepted. The following patient's course seems to support this theory:

A seaman of 39 became comatose two weeks after an injury to the head. When first seen he appeared moribund, having stertorous irregular respirations, almost continuous right-sided convulsive movements, and a temperature of 39.5°. A right-sided subdural hematoma was exposed through a small subtemporal opening under novocaine anesthesia. The contents of the hematoma were somewhat thick and had the color of fresh venous blood. After evacuating the hematoma as thoroughly as possible, the underlying cortex showed no tendency to expand to obliterate the space formerly occupied by the hematoma. Lumbar

puncture was then made; the intraspinal pressure was so low that no fluid would run from the needle when the stilet was withdrawn. Normal saline solution was then introduced into the lumbar subarachnoid space until the pressure was raised to 200 mg. of fluid; this required approximately 100 cc. of solution. The cerebral hemisphere expanded to almost normal size and a considerable additional amount of bloody fluid was forced out of the sac. Thorough irrigation of the sac with saline was carried out, and the wound was closed without drainage. The patient recovered promptly after operation.

Approximately a month after operation the patient began to complain of headache. Bilateral papilloedema appeared. As bilateral exploration had not been made at the time of operation on account of the patient's poor condition, a left-sided hematoma was suspected. Exploration carried out on the left side failed to reveal a hematoma. Exploration on the right side, the side of the original hematoma, showed the membrane of a hematoma which contained approximately 125 cc. of clear, lemon yellow fluid. It is our belief that this fluid, which differed greatly from that found at the first operation, was produced by the further breakdown of blood which had remained in the hematoma sac at the first operation. Following the second operation the patient recovered completely and has resumed his previous occupation.

The clinical history of patients with subdural hematoma may, as a rule, be recognized without great difficulty. Hematomas coming to operation within two weeks of injury are termed acute, while after that time they are termed chronic subdural hematomas. The condition appears to be essentially the same in each. Acute subdural hematoma is commonly associated with a fairly severe head injury, and fracture of the skull is seen much more frequently than in chronic subdural hematoma. In such instances, the individual does not as a rule recover fully from his initial injury. He remains drowsy or stuporous and shows a tendency to become increasingly so. Frequently hemiparesis appears, and there is usually dilation of the pupil on the side of the hematoma. Hemiparesis is as likely to be ipselateral as contralateral. At times it is difficult to differentiate between acute subdural hematoma and extradural hematoma. Acute subdural hematomas are frequently associated with laceration and other damage to the brain. The mortality of operative treatment is high, varying from 40%[16] to 90%.[17] This high mortality has led some surgeons[17] to suggest that operations in individuals with acute subdural hematomas are contraindicated. A considerable number of patients, however, recover completely after operation.

In chronic subdural hematoma headache may be present at the time of injury, and at times persists thereafter. More commonly there is a period of from one to three months or more, probably depending upon the size of the hematoma, in which the patient is free from all symptoms. Headache then appears; it at times is unilateral although usually it is of a generalized character. Headache is frequently more severe in the frontal and occipital regions. With the passage of time the headache tends to become increasingly frequent and severe but is rarely, if ever, constant. With the advent of more severe and frequent headaches, the patient usually becomes stuporous. He may become comatose for a day or two after which he will usually again arouse for a period, only to again become comatose. Several such episodes may occur before the patient's death in coma if the condition is not recognized and treated surgically. Along with the

headache, an impairment of recent memory of some degree can usually be demonstrated. Often changes in the personality of the individual are apparent. The patient often fails to recognize the severity of his illness. He may be suspicious and he may have exaggerated ideas of his own ability. Although as a rule these changes are not prominent they may at times dominate the clinical picture. Neurological signs as a rule are inconspicuous. At times there may be some nuchal rigidity. Often there is tenderness to percussion over the skull, especially on the side of the hematoma. There may be inequality of the pupils; usually the larger pupil is on the side of the hematoma. In a few patients contralateral hemiparesis appears; this usually is quite late. The weakness is more marked in the upper extremity than in the lower. Hemiparesis is usually accompanied by increased tendon reflexes and an extensor plantar response. Papilloedema is present in approximately 50% of individuals with subdural hematoma.

In infants subdural hematoma is rarely recognized before the age of 4 or 5 months, when enlargement of the head is the most prominent feature. Whether the hematoma is always the result of birth injury in these early cases appears somewhat uncertain. Lowered Vitamin C content of the blood is usually present in infants with subdural hematoma. Although some of these infants appear to be acutely ill, this is not usually true. The appearance of enlargement of the head with tenseness of the fontanelle in an otherwise normal infant is the rule on examination.

In the presence of a typical clinical picture spinal fluid examination is unnecessary and may be of definite danger. One of our patients became comatose two hours after the slow removal of 10 cc. of spinal fluid. He was rescued by the prompt evacuation of a bilateral subdural hematoma. In instances when the diagnosis is in doubt, spinal fluid examination should be made. There is usually a moderate increase in the spinal fluid pressure, but this is not invariably true; we have encountered cases, particularly in comatose and dehydrated patients, in whom the pressure was so low that no fluid escaped from the needle after withdrawal of the stilet. In approximately 50 per cent of the cases, the spinal fluid is xanthochromic, and a moderate increase in the spinal fluid protein is almost always present.

X-ray of the skull has rarely been of aid in establishing the diagnosis. Displacement of the pineal gland may be of aid when present and suggests a space-occupying lesion. Pneumoencephalography may be required at times to establish the diagnosis.

The treatment of subdural hematoma, if undertaken before the patient is moribund, is extremely satisfactory. Although lumbar puncture has apparently benefited some of these patients temporarily and although hematomas may perhaps be absorbed spontaneously when their volume is not too great, prompt surgical intervention is indicated when subdural hematoma is believed present. Aspiration of the hematoma through the fontanelle in infants is indicated. According to those of great experience[18] it is necessary in infants to remove both the inner and outer membranes of the sac in order to effect a complete and permanent cure. This, of course, requires an osteoplastic craniotomy. It is feared in infants that the presence of the membrane may hinder the development of the rapidly growing brain. In adults bilateral bur openings are made at points suitable for ventriculography, preferably under novocaine anesthesia. In almost every instance, if a hematoma is present it will be exposed by such openings and may be evacuated. If no hema-

toma is found, a ventriculogram should be made in the usual manner. A unilateral hematoma of sufficient size to be of clinical significance will produce displacement of the ventricular system to the opposite side; bilateral hematoma, however, may fail to show such displacement. Rarely, subdural hematoma occurs over the cerebellum; a ventriculogram will show a generalized dilatation of the lateral and third ventricles in such instances. Additional exploration through bur openings is indicated when there are ventricular abnormalities shown by the pneumoencephalogram. When a subdural hematoma is present, the dura when exposed after perforation of the skull is often discolored blue or gray. The outer membrane of the hematoma is usually plum colored or slate gray. The outer membrane of the hematoma is opened and the fluid in the sac is allowed to escape; the head is lowered to increase the intracranial pressure and facilitate as complete evacuation as possible. When no additional fluid escapes spontaneously, the interior of the sac is irrigated with normal saline solution until the return flow is clear and colorless. Usually the hematoma contains 100 to 150 cc. or more fluid. If the cerebral cortex fails to expand after evacuation of the hematoma, lumbar puncture is made and normal saline solution is introduced into the subarachnoid space until a pressure of 200 mg. of fluid exists. This usually causes expansion of the cortex. Postoperatively such patients are given large amounts of fluid parenterally, are kept flat in bed, and are hyperventilated with a carbon dioxide-oxygen mixture every four hours. These measures tend to increase the intracranial pressure and further the obliteration of space formerly occupied by the hematoma. A small rubber tissue drain is always left in the hematoma sac at the time of closure of the wound. Occasionally, fairly large amounts of fluid drain from the hematoma sac during the first postoperative day or two. The drain is removed after the cessation of drainage. Fresh bleeding into the hematoma sac after operation apparently never occurs. On account of the frequency of bilateral hematoma bilateral exploration should always be carried out.

Recovery in patients with subdural hematoma is dramatic and complete. Usually within a few days after operation the patient has completely recovered. Except for the patient mentioned previously, none of our patients has required a second operation. We have had no deaths in patients with chronic subdural hematoma.

SUMMARY

Subdural hematoma is an occasional complication of cranio-cerebral trauma caused by the extravasation of blood into the subdural space where no mechanism for its prompt absorption exists. Although the condition exists in acute and chronic forms, the latter is more common. Symptoms of headache, drowsiness, and stupor may date from the time of injury, but more commonly there is a period of one to three months, or more, after injury during which the patient is apparently well. Neurological signs as a rule are inconspicuous. Bilateral hematomas are present in a considerable percentage of patients. Evacuation of the hematoma through bur openings is the treatment of choice and is attended by a low mortality. In practically all cases complete and speedy recovery occurs in patients with chronic subdural hematomas.

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SUMARIO

Hematoma subdural es una complicación ocasional de traumatismos craneocerebral causado por la extravasación de sangre dentro del espacio subdural donde no existe mecanismo para su absorción rápida. Aunque la condición existe en formas agúda y crónica, la ultima es mas comun. Síntomas de dolor de cabeza, entorpecimiento y estupor pueden estar presente desde el tiempo de la lesion, pero mas comunmente hay un periodo como de dos a tres meses o mas en el cual el enfermo está aparentemente bien. Sígnos neurológicos por regla general son inconspicuos. Hematoma bilaterales estan presente en un por ciento considerable de enfermos. Evacuación del hematoma a través de una abertura de fresa es el tratamiento a elegir y tiene una mortalidad baja. Practicamente en todos los casos una mejora rápida ocurre en enfermos con hematoma subdural crónico.

RÉSUMÉ

Ces hématomes surviennent assez souvent après les traumatismes cranio-cérébraux. Ils résultent d'un épanchement de sang dans l'espace sous-durien vu l'absence d'un mecanisme pouvant effectuer une absorption rapide du sang extravase. Les symptômes peuvent revêtir ou une forme aigué ou une forme chronique. La forme chronique est la plus fréquente. Les maux de tête, la somnolence, la stupeur peuvent survenir au moment de l'accident, mais ordinairement un, deux ou plusieurs mois s'écoulent avant, leur apparition. Durant cet intervalle le malade parait être en bonne santé. Les signes néurologiques le plus souvent, ne sont pas manifestes. Dans un pourcentage considerable des malades, les hématomes sont bilatéraux. Le traitement de choix est l'évacuation de l'hématome. Les résultates de ce traitement sont très satisfaisants. La mortalité de cette intervention est négligible. La guérison après l'evacuation du sang epanché, est rapide et complete dans presque tous les cas d'hématome sous-durien chronique.

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Traumatic Subcortical Hematoma*

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THE management of acute cranio-cerebral trauma necessitates the consideration of innumerable pathological processes. Some of these conditions, if recognized in time, prove amenable to surgical treatment. In considering the treatment of head injuries as a whole, very little detailed information related to a single entity can be given. It has therefore seemed worthwhile to give this report limiting my remarks to the problem of intra-cerebral hemorrhage.

Occasionally one encounters a patient with hemiplegia occurring almost immediately after or within a short period following a cranio-cerebral injury. The question of operative intervention is, of course, of major importance at the time, in view of the fact that a massive hemorrhage from the middle meningeal artery may be present. As the patient is observed no true phenomena of cerebral compression can be elicited and, recognizing that cerebral contusion and laceration may account for the hemiplegia, conservative measures for the treatment of the injured brain and traumatized cranium are instituted. Observation for signs of any surgically correctible lesion must be continued for several days.

Within a period of a few weeks two patients in whom this phenomenon was present were observed in a local hospital. Each weathered the initial distress of shock and damage to the cranium but signs of the hemiplegia persisted. Careful observation gave no evidence of a massive extra-dural or sub-dural clot and conservative measures were used in combatting cerebral edema. They respondded well but the hemiplegia persisted. Subsequently in spite of more drastic measures for reducing cerebral edema they underwent changes in consciousness with stupor increasing steadily. Throughout this time the alteration of blood pressure was slight, there was a lack of bradycardia, and no sign of unilateral dilitation of the pupils to suggest a rapidly increasing mass such as clot formation with hemorrhage from the middle meningeal artery. The downward progress conformed to the symptomatology observed in cases of sub-dural hematoma or a similar lesion within the brain substance. In each case, exploration was deemed advisable and a sub-cortical hematoma was encountered in the right temporo-parietal region. The response to treatment by aspiration was quite satisfactory and the patients responded in very much the same manner that cases of sub-dural hematoma improve with evacuation or removal of the sub-dural mass.

These two cases are being reported because they represent a rather classical clinical syndrome which if observed opens up an avenue for relief of the condition which otherwise rapidly approaches a fatal termination.

Case 1: F. L. E., No. 43099—white male, age 65, was admitted to Oklahoma General Hospital June 12, 1941. Neurosurgical consultation was requested by Dr. J. E. Harbison, Oklahoma City. In mid-morning on the day of admission the patient had been found unconscious on the floor of his office with profuse hemorrhage from multiple lacerations of the scalp. These injuries proved to have been inflicted by a bandit in an attempted robbery.

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On admission to the hospital he was beginning to respond but remained semi-comatose. His blood pressure was 90/60, pulse 138, and temperature 96°. Supportive treatment was instituted. Neurological examination revealed signs of a hemiplegia on the left including the lower half of the face. The pupils were equal. Following a response to treatment for shock, x-ray plates of the skull were obtained which revealed a linear fracture extending upward from the right temporal region into the frontal and backward into the parietal bone.

After five hours, my associate, Dr. Herrmann, considered the patient's condition satisfactory to permit repair of the scalp wound and this he did at that time. In all, there were about 10 separate contused lacerations, several of which exposed the bone. These were débrided as best one could, sulfanilamide powder was instilled and layer closure without drainage was carried out in so far as it was possible to close in layers. Others were closed by through and through sutures of silk.

His subsequent course was for a time one of improvement except for signs of the hemiplegia which remained stationary. After 8 days he had a rather severe urticarial reaction to the prophylactic serum given on the day of admission. At the end of two weeks the wounds had healed completely but his hemiplegia persisted. He was somnolent but could be aroused easily.

At this time signs suggesting the presence of a hematoma were observed. He became stuporous. Intravenous hypertonic glucose and retention enemas of magnesium sulphate were given without benefit. Bilateral positive Babinski signs were elicited, his swallowing became impaired, and by the 16th day following the trauma it became apparent that unless something could be done to give relief, a fatal termination was near. The optic discs remained clearly outlined and the pupils equal.

Under local anaesthesia, on June 28, 1941, a perforator and burr opening was made 3 cm. above the ear on the right side. The extra and subdural spaces were clear of blood. The intra-cranial tension was increased moderately. Its color was normal. At a depth of 4 cm. in the superior part of the temporal lobe a hemorrhagic cyst was encountered from which 50 c. c. of old liquefied blood was removed by aspiration.

His post-operative course was satisfactory except for certain residual conditions to be mentioned. He rapidly regained consciousness and his general improvement paralleled that of a subdural hematoma. He was dismissed from the hospital July 16, 1941, with steady improvement in the motor function of the face and leg but with very little motion even of gross character in the left arm.

On two occasions he has had a generalized convulsion, the last of which was early in November, 1941. His cerebration is excellent. He has not returned to work because of persistent impairment in use of the left side, although improvement continues by his constant effort.

This result is not entirely satisfactory because he failed to completely regain the function in the left arm and has had two convulsions. Possibly a wider exposure with removal of the clot through a transcortical incision as advocated by Klemme (1) would have been warranted. However, one must recall that the hemiplegia occurred immediately with the injury and it is our opinion that actual destruction of a portion of the fibers in the internal capsule account for the motor signs. At any rate the blood was liquefied and easily removed by aspiration. Subsequently, the original neurological phenomena did improve but the recovery was incomplete.

Case 2: B. I. H., No. 43617—white male, age 53, was admitted to Oklahoma City General Hospital July 31, 1941. Patient examined in consultation with Dr. A. S. Phelps, Oklahoma City.

He had been thrown from his car in a collision and struck his head on the pavement. As he was placed in the ambulance it was observed that he retained full motion in both arms and both legs but by the time he reached the hospital the left side was hemiplegic. The scalp was lacerated in the left frontal region. Marked swelling and ecchymosis of the lids of the right eye was noted. He remained semi-conscious and there was very little evidence of shock.

In a period of four days the temperature increased to 101. The pulse varied from 80 to 90 and the blood pressure remained constant averaging 142/90. X-ray plates revealed a linear fracture, without depression, extending from the right orbit upward and posteriorily through the parietal bone.

From this information it was concluded that he had sustained a severe contusion of the brain; but the presence of the hemiplegia which developed too soon after injury to be accounted for by cerebral edema suggested the presence of a massive intracranial hemorrhage. His stupor was lessening until on the 8th day after injury. He then became progressively more stuporous, the hemiplegia persisted, the blood pressure increased to 170/90 and pulse rate 124 with temperature 101.8. No evidence of papilledema or disturbance in size of pupils were noted at any time.

In spite of vigorous effort to dehydrate the brain, his stupor increased and preparations were made to explore for an intra-cranial clot possibly a subdural hematoma but most probably a subcortical hematoma.

Operation: On August 7, 1941, under local anaesthesia, a perforator and burr opening was made high in the right temporal region. A very thin film of blood clot was removed from the subdural space. At a depth of 5 cm. a hematoma was encountered and 35 c.c. of liquefied and disintegrating blood was aspirated. With a change of direction the temporal horn of the lateral ventricle was tapped and clear colorless fluid obtained. The wound was closed in layers using silk.

On his return to his room he was conscious, responsive to commands, and could move his left arm to painful stimulation. His improvement was rapid. After 10 days he persisted in showing a slight weakness of the left 6th nerve but it too was improving. He was dismissed from the hospital on the 11th post-

operative day and has remained symptomless from that time. He was permitted to return to work after 90 days.

COMMENT

The onset of left-sided paralysis after a brief interval suggested hemorrhage and he was carefully observed for signs of a cerebral compression from hemorrhage due to rupture of the middle meningeal artery. Subsequent increasing stupor in spite of measures to reduce intra-cranial pressure gave a definite clue to the presence of a hematoma. In this as well as Case No. 1 sufficient time elapsed to permit an enlargement of the hematoma by osmosis as described by Zollinger and Gross.[2] This was borne out by the absence of evidence of persistent hemorrhage at the time of operation, the aspirated material having remained characteristic of that removed from chronic subdural hematomata.

Both of these men were past fifty. Each sustained a severe cranio-cerebral injury. Undoubtedly the trauma was a major factor with the aging process in the cerebral vessels playing a contributing role. The location of the hemorrhage in these cases conformed to the observation of Naffziger,[3] Pilcher,[4] Craig and Adson[5] and Furlow,[6] in that both were in the temporo-parietal area. Occasionally one may encounter this lesion in the occipital or frontal lobe and rarely in the cerebellum. Our series of subcortical hemorrhage now numbers fourteen. All have been temporal or parietal with the exception of one trauma case with the lesion in the left cerebellar hemisphere. Four cases were due to tumor, two were spontaneous and of unknown etiology. Eight cases due to trauma have been encountered, four of whom were seen in extremis soon after the injury and four, including the two cases reported in detail at this time, have presented the more characteristic progression of symptoms of the chronic hematoma type.

SUMMARY

Two cases of sub-cortical hematoma of traumatic origin have been presented in detail. Both patients recovered from the immediate effects of cerebral compression. One patient persists in showing signs of partial hemiplegia and has had two convulsions. The other recovered from all signs of the hemiplegia.

The symptomatology and diagnosis in these cases has been presented to encourage consideration of this correctible condition when treating cranio-cerebral trauma cases in whom hemiplegia occurs at the time of, or soon after, the injury.

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6. Furlow, L. T., Carr, A. D., and Wattenberg, C., Spontaneous Cerebral Hemorrhage: The Surgical Treatment of Selected Cases. Surgery *9*:758. 1941.

SUMARIO

Dos casos de hematóma sub-cortical de origen traumático han sido presentados. Ambos enfermos recobraron de los efectos inmediatos de la compresión cerebral. Un enfermo persitió en mostrando señales de hemiplégia parcial y ha tenido dos convulsiones. El otro recobró de todas las señales les de hemiplégia.

La sintomatologia y diagnósticos en estos casos ha sido presentados para estimular consideraciones de esta condición corregible cuando tratando casos de trauma craneo-cerebral en los cuales hemiplegia ocurre durante el tiempo, o despues del traumatismo.

RÉSUMÉ

L'auteur rapporte en détail deux hématomes sous-corticaux d'origine traumatique. Les deux malades furent

guéris des consequences immédiates de la compression cérébrale. Un des malades souffre encore d'une hémiplégie partielle et a eu deux convulsions. L'autre ne montre aucun symptôme hémiplegique.

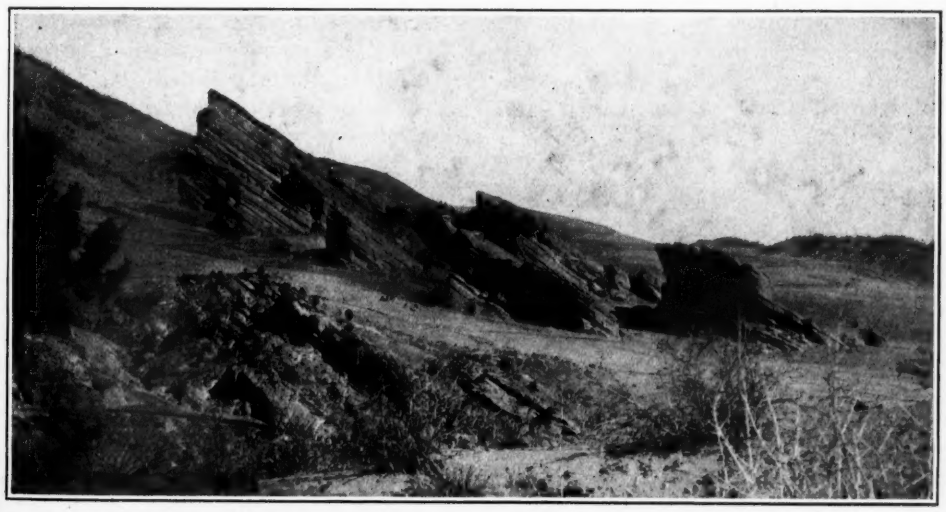
L'auter discute la symptomatologie et le diagnostic de ces cas afin d'encourager l'étude des traumatismes cranio-cérébraux accompagnés d'hémiplégie survenant au moment ou peu aprés l'accident causatif.

MEDICO-SURGICAL MOTION PICTURES

Those desiring to submit films to the Board of Review of Medico-Surgical Motion Pictures of the International College of Surgeons should submit these to:

Board of Review, Medico-Surgical Motion Picture Films, 104 E. 40th Street, New York, New York.

Dr. Joseph Franklin Montague, *Chairman.*



One of many beautiful, cool summer resorts in the Rockies, close to Denver.

The President's Page

IN KEEPING abreast of modern progress and scientific demands, the International College of Surgeons has organized a Medico-Surgical Censor Board for Motion Pictures, as library and property of the College, intended to assist its membership in the diffusion of knowledge and surgical experiences throughout the world.

It has long been recognized that motion pictures illustrating case presentations, clinical and other findings, technical procedures and statistical tabulations of results have developed as a potent factor in modern teaching of medical students, in medical societies and as a means of carrying to all medical centers of the world the work in progress.

The importance of cinematography, therefore, cannot be over estimated, and at the Denver National Assembly scheduled for July 15-18, that large medical Congress will have the advantage of a rich display of moving pictures.

Never in the history of our country has there been a better spirit of patriotism, self sacrifice at any cost, and readiness to lend our special services to the nation, to the Government and to the armed forces of the United States as is being demonstrated from day to day. The membership of the United States Chapter of the International College of Surgeons is displaying one hundred per cent participation in all the activities required now and for further development in which medical organization can render timely and efficient help. We like to dwell upon this subject in justice to the marvelous spirit of abnegation shown on the part of the men who are now in the various fighting fronts, as well as those who are ready to respond to the call when the time comes. Furthermore, the College as a surgical organization is on record with the proper authorities to enlist its expert war surgery activities in teaching and, by all means at its command, to add to the existing coordinated efforts of organized medicine and surgery, in order to furnish prompt and adequate cooperation in these urgent times.

Many and fruitful suggestions as to the ways in which we can be of help to the Government and to the Nation have been carefully studied and presented. Those who made the suggestions endeavored to cover all possible needs based not only upon the experiences of the first World War, but also upon the experiences of the war surgery of the Allied forces which throughout the world are rendering most brilliant results. Reports of these activities are reaching us in up-to-the-hour efforts to maintain constant touch and aid in every possible way, whether by lectures to sanitation officers in the Army and Navy, or by aiding in training of Junior officers, or by organizing groups of medical officers to be taken to civil hospitals for short periods of intensive training in all conditions likely to be met with in the war, or even by training of groups of hospital corps men for naval service.

The Denver Assembly promises to be one of the outstanding medical gatherings this summer, and we have every reason to believe that notwithstanding war conditions and traffic slowing up, that the attendance will be an unusually large one. We base our expectations not only by the able arrangements of the Committee in charge in Denver, but by the splendid acceptance of scientific

contributions from a large number of outstanding authorities on various surgical and medical subjects.

A special effort is being made to introduce some of the newest scientific advancements in all specialties of general surgery, but, as stated before, the moving picture program has in store some surprises that will hold the interest of scientific men, and that will be effective in the creation of new methods of illustrating in a pictorial way physiological phenomena heretofore relegated to didactic exposition.

DESIDERIO ROMÁN, M.D.

NEWS ITEMS

Dr. Manuel A. Manzanilla, Vice President of the International College of Surgeons, has just been made a member of the National Academy of Medicine of Rio de Janeiro, which was founded in 1829.

Dr. Harry E. Bacon, Fellow of the International College of Surgeons, was elected Professor and Head of the Department of Proctology of the Medical School of Temple University, Philadelphia, Pennsylvania.

Dr. Fred H. Albee of New York, N. Y., addressed a large group of medical officers at the Army Medical School (Walter Reed Hospital) at Washington, D. C., on Tuesday, April 7th, 1942. The subject of Dr. Albee's lecture was "A Report and Analysis of 1,147 Ununited Fractures With or Without Loss of Bone Substance." These cases were done during the First World War and in practice before and after the War.

Dr. Thomas Parran, Jr., Surgeon General of the United States Public Health Service, and **Dr. Vannevar Bush,** President of the Carnegie Institute of Washington, received honorary degrees on the occasion of the one hundred and seventy-sixth anniversary of Rutgers College.

The LL.D. degree was conferred on **Doctor Max Thorek** by Lincoln Memorial University, at their convocation in June.

The Jacksonian Prize for the year 1941 of the Royal College of Surgeons, London, has been awarded to **W. Bremner Highet,** of the Wingfield Morris Orthopaedic Hospital, for his essays on "Injuries to Peripheral Nerves, with Especial Reference to the Late After Results." The John Tomes Prize for the years 1939-41 has been awarded to R. V. Bradlaw, for his work on the microscopical structure of the dental tissue.

Dr. Julius Hass, who formerly occupied the chair of orthopedic surgery at the University of Vienna, has been appointed attending orthopedic surgeon, in charge of the Orthopedic Service, at Montefiore Hospital, New York City.

The Institución Cultural Española in Buenos Aires has established a laboratory for histopathologic research in memory of **Professor S. Ramón y Cajal** to be directed by **Professor Pío del Río Hortega** of Buenos Aires with a staff of eight investigators. The institute will promote investigations on the histology of the nervous system, employing the technic of Cajal and his school.

The University of San Marcos, Peru, has awarded the degree of doctor *honoris causa* to **Dr. William Seaman Bainbridge,** of New York City, in recognition of his work on cancer and his contributions to medical progress in Latin America.

A ceremony in memory of **Polish professors** who lost their lives as a result of the German occupation of Poland recently took place at the Royal Institution, London, under the presidency of Sir David Ross, vice-chancellor of the University of Oxford. Tribute to their work was paid by Sir William Bragg, formerly president of the Royal Society; by Professor Gilbert Murray, of the University of Oxford, and by Professor Antoni Jurasz, dean of the Polish Medical School at the University of Edinburgh.

Professor Jean Perrin, Nobel laureate in 1926, formerly president of the French Academy of Sciences, died on April 17 at the age of seventy-one years. Since Dr. Perrin came to the United States last December he has been dean of the faculty of sciences of the recently established Franco-Belgian Free School of Higher Studies.

Dr. Joseph Bolivar De Lee, emeritus professor of obstetrics and gynecology at the University of Chicago, died on April 2, at the age of seventy-two years.

Dr. Hugh H. Young, editor of the *Journal of Urology,* having reached the age of seventy-one years, will retire on July 1 as professor of urology and as director of the Brady Urological Institute at the Johns Hopkins Hospital.

The Vichy Government has announced the establishment of the **Alexis Carrel Foundation** for Study of Human Problems, under the direction of Dr. Carrel.

A new wing of the **Barros Luco Hospital** at Santiago, Chile, has been named for **Dr. Joseph Francis McCarthy,** professor of urology at Columbia University and director of the department of urology of New York Polyclinic Medical School and Hospital.

A bronze statue of the late **Drs. William J. and Charles H. Mayo** in their surgical gowns will be the central point of interest of the Mayo Memorial Shrine to be erected in Rochester by residents of the city and Olmstead County. It will be placed on a granite base before a granite background in the central open space of an amphitheater, symbolic of operating rooms. The shrine, designed by James Earle Fraser, New York sculptor, will be separate from that being planned by the Minnesota Memorial Commission. This commission was appointed by Governor Stassen late in 1940 to study the establishment of a $250,000 fund for a memorial to the Mayos. State Senator William B. Richardson, Rochester, is chairman of the commission, which is composed of seventeen representative citizens of Minnesota.

The death is announced of **Dr. Filippo Bottazzi,** professor emeritus of physiology at the University of Naples. Dr. Bottazzi was president of the fourteenth International Congress of Physiology which was held in Rome from August 29 to September 3, 1932.

Dr. Fred W. Rankin, of Lexington, Ky., president-elect of the American Medical Association, has been appointed chief consulting surgeon of the Army and will assume the post on March 1 with the rank of colonel.

Sixth Annual Assembly, United States Chapter International College of Surgeons

Denver, Colorado, July 15 to 18, 1942

Under the Auspices of the Colorado State Guild

of the International College of Surgeons

Headquarters: Shirley-Savoy Hotel

COMMITTEE ON ARRANGEMENTS

Dr. George Gillen
Chairman of Committees

Dr. J. Rudolph Jaeger
Director of the Assembly

PROGRAM COMMITTEE:
Dr. George H. Gillen, *Chairman*
Dr. Kenneth C. Sawyer

HOUSING COMMITTEE:
Dr. Dean W. Hodges, *Chairman*
Dr. George F. Netherton

ENTERTAINMENT COMMITTEE:
Dr. Hamilton I. Barnard, *Chairman*
Dr. N. Paul Isbell

REGISTRATION:
Dr. E. L. Harvey, *Chairman*

EXHIBIT COMMITTEE:
Dr. Nolie Mumey, *Chairman*
Dr. J. Rudolph Jaeger

PUBLICITY COMMITTEE:
Dr. J. Rudolph Jaeger, *Chairman*
Dr. George B. Kent

HOSPITAL CLINICS:
Dr. Henry A. Buchtel, *Chairman*
Dr. Thomas E. Carmody
Dr. Haynes J. Freeland
Dr. M. C. Waddell

J. Rudolph Jaeger, M.D., F.I.C.S.
Director of the Assembly

International College of Surgeons
Denver, Colorado

Gentlemen:

Colorado is honored to be selected as the United States National Assembly place for the International College of Surgeons in Denver from July 15th to 18th of this year.

May we hope that the distinguished members of your great organization will pause long enough from the transaction of the business of your convention to visit some of our mountains, learn of our good highways, do some trout fishing in our streams and to know why we call our state "the top of the world."

All of Colorado joins in bidding you welcome. We hope that your stay may be so pleasant that you will make Colorado your summer homes.

Very truly yours,

Ralph L. Carr
Governor of Colorado
Denver, Colorado

J. Rudolph Jaeger, M.D.
Vice-President, International College of Surgeons
502 Republic Building, Denver, Colorado

Dear Doctor Jaeger:

The Colorado State Medical Society, its officers and members, welcome the national assembly of the International College of Surgeons to Denver.

We are honored to have this national gathering of prominent national and international surgeons enjoy with us the beauty of our State and the extensive educational facilities that it affords.

Sincerely yours,
G. C. Cary, M.D., President
Colorado State Medical Society
Grand Junction, Colorado

May 5, 1942

International College of Surgeons
Denver, Colorado

Gentlemen:

As Mayor, of the City of Denver, Colorado, I am pleased, indeed, to know that the Officers and Members of your organization have decided to hold your Annual United States National Assembly in our City on July 15, 16, 17, and 18th. of this year.

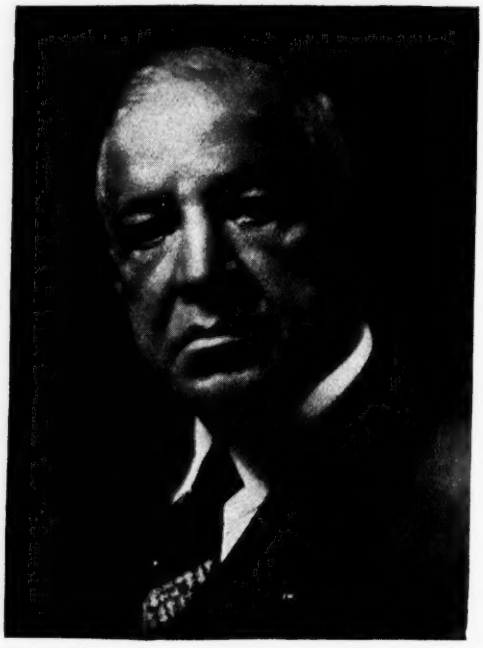
I want to extend to you, on behalf of the citizens of Denver, and myself, a very sincere welcome and to assure you that we will put forth our best efforts to see that you have a beneficial and enjoyable meeting. We know that the Physicians and Surgeons here appreciate, very much, your meeting here.

I want to assure you again that we will be glad to have you meet with us and hope that you will feel free to call for any services which we may be able to render.

Hoping to see many of you, if not all, I am

Very sincerely yours,
Ben F. Stapleton
Mayor

April 28, 1942



Desiderio Roman, M.D., F.I.C.S.. F.A.C.S.
National President

GREETINGS FROM THE PRESIDENT OF THE UNITED STATES CHAPTER

Men of science and of the arts gather together at stated time and place, and in convention deliberate upon the latest contributions to the advancement of medical knowledge in general, as well as on special topics, and in panel discussion and correlated demonstrations elucidate the diversified experiences from leaders of the medical profession and specialists.

The Sixth Annual National Assembly of the United States Chapter of the International College of Surgeons in the city of Denver, Colorado, on July 15 to 18 inclusive, will offer a comprehensive program of the highest scientific interest, with panel discussions and demonstrations of leading problems in medicine. The program represents contributions from outstanding members of the profession in the United States and foreign guests.

The attendance will be large, notwithstanding the necessary limitations brought about by the war conditions, and the program will include, as a special feature, discussion of war injuries and war surgery, in the presentation of which there will take part Army and Naval Officers of the present, as well as of the First World War.

The admirable hospitality of the Denver Committee will be displayed as never before in the history of medical gatherings in that city, and it is a rare opportunity that the seasonal and vacational attractions of the Middle West will be offered in connection with this scientific gathering.

On behalf of the United States Chapter of the International College of Surgeons, it is my privilege and pleasure to extend a most cordial and enthusiastic welcome to the members of the medical profession and their guests, assuring them of both scientific and recreational advantages.

Desiderio Román, M.D.

PROGRAM

International College of Surgeons
National Assembly

Denver, Colorado

July 15, 16, 17, and 18, 1942

Headquarters and Meeting Place—Shirley-Savoy Hotel

TUESDAY AFTERNOON, JULY 14th—REGISTRATION
Exhibit Hall, Shirley-Savoy Hotel

WEDNESDAY, JULY 15th

8:30 A.M. ACUTE ABDOMEN.
Edwin C. Henry, M.D., F.I.C.S., Omaha, Nebraska.

8:50 A.M. Discussion opened by Kenneth C. Sawyer, M.D., F.I.C.S., F.A.C.S., Denver, Colorado, and William H. Mast, M.D., F.I.C.S., F.A.C.S., Gunnison, Colorado.

9:00 A.M. A NEW AND FUNCTION-RESTORING OPERATION FOR BILATERAL ABDUCTOR CORD PARALYSIS (With motion pictures of vocal cords before and after operation).
Brien T. King, M.D., F.A.C.S., Seattle, Washington.

9:30 A.M. SOME OF THE PITFALLS IN THYROID SURGERY.
Andre Crotti, M.D., F.I.C.S., F.A.C.S., Columbus, Ohio.

9:50 A.M. Discussion of papers by Dr. King and Dr. Crotti opened by M. O. Shivers, M.D., F.I.C.S., Colorado Springs, Colorado, and H. J. Freeland, M.D., F.I.C.S., F.A.C.S., Denver, Colorado.

10:00 A.M. INTERMISSION to view exhibits.

11:00 A.M. CIRUGIA DE LA DIABETES MELLITIS
Manuel A. Manzanilla, M.D., F.I.C.S., Mexico City, D.F.

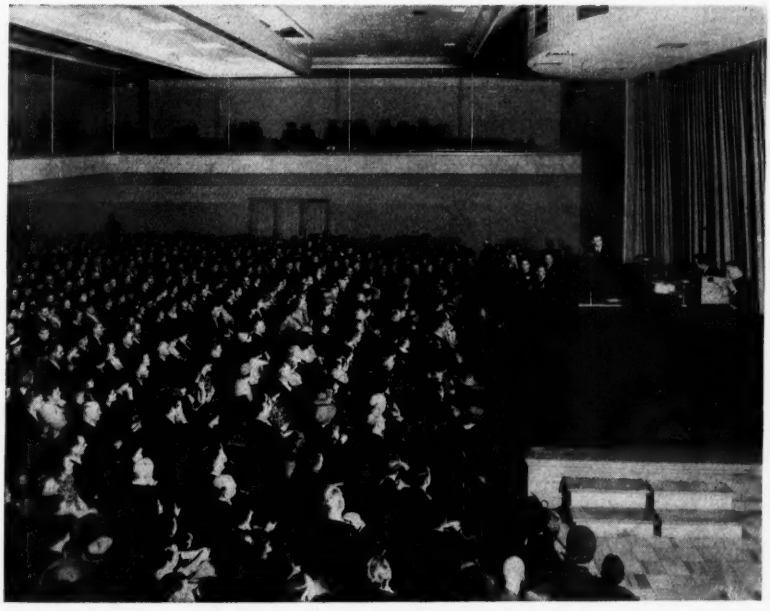
11:20 A.M. Discussion opened by C. F. Kemper, M.D., Denver, Colorado.

11:30 A.M. THE CLINICAL END RESULTS OF TWENTY-FIVE YEARS' EXPERIENCE OF SUBTOTAL GASTRECTOMY FOR GASTRIC AND DUODENAL ULCER.
Alfred A. Strauss, M.D., F.I.C.S., F.A.C.S., Chicago, Illinois.

11:50 A.M. Discussion opened by Charles Arnold, M.D., F.I.C.S., Lincoln, Nebraska, and Lanning E. Likes, M.D., F.I.C.S., F.A.C.S., Lamar, Colorado.

12:00 M. *Round-Table Luncheon*—Silver Glade Cosmopolitan Hotel.
Dr. Clark D. Brooks, Detroit, Michigan, Presiding.
Drs. Henry, King, Crotti, Manzanilla, and Strauss participating.

2:00 P.M. TREATMENT OF TUMORS OF THE UPPER URINARY TRACT.
Elmer Hess, M.D., F.A.C.S., Erie, Pennsylvania.



2:20 P.M. Discussion opened by Edward B. Liddle, M.D., F.I.C.S., F.A.C.S., Colorado Springs, Colorado, and Henry A. Buchtel, M.D., F.I.C.S., Denver, Colorado.

2:30 P.M. CHEMOTHERAPY AS RELATED TO SURGERY.
Arnold S. Jackson, M.D., F.A.C.S., Madison, Wisconsin.

2:50 P.M. Discussion opened by Richard W. Whitehead, M.D., Denver, Colorado.

3:00 P.M. INTERMISSION to view exhibits.

4:00 P.M. OSTEOGENIC SARCOMA WITH REPORT OF 65 CASES.
Thomas A. Shallow, M.D., F.I.C.S., F.A.C.S., Philadelphia, Pennsylvania.

4:20 P.M. Discussion opened by Wm. Carpenter MacCarty, M.D., Rochester, Minnesota, and Hamilton I. Barnard, M.D., F.I.C.S., F.A.C.S., Denver, Colorado.

4:30 P.M EVALUATING THE WORK OF THE SURGEON.
T. R. Ponton, M.D., Chicago, Illinois.

4:50 P.M. Discussion opened by William R. Lovelace, M.D., F.I.C.S., Albuquerque, New Mexico, and Donat F. Monaco, M.D., F.I.C.S., F.A.C.S., Gallup, New Mex.

5:00 P.M. AN IMPROVED OPERATION FOR REPAIR OF INGUINAL HERNIA (With lantern slides).
E. Vernon Mastin, M.D., F.I.C.S., F.A.C.S., St. Louis, Missouri.

5:20 P.M. Discussion opened by W. T. H. Baker, M.D., F.I.C.S., F.A.C.S., Pueblo, Colorado, and Nolie Mumey, M.D., F.I.C.S., F.A.C.S., Denver, Colorado.

6:30 P.M. Stag Dinner—Silver Glade, Cosmopolitan Hotel.

8:00 P.M. Military Symposium — Shirley-Savoy Hotel.
Colonel Frederic S. Wright, M.D., F.A.C.S., Presiding.
Commanding Officer, Fitzsimons General Hospital, U. S. Army, Denver, Colorado.
Commander Joseph Madison Greer, M.D., F.I.C.S., F.A.C.S., MC USNR Chief of Surgery, U. S. Naval Hospital, San Diego, California.
John Amesse, M.D., State Chairman Procurement and Assignment Service Denver, Colorado.
Mr. Harvey Sethman, Executive Secretary Colorado State Medical Society, Denver, Colorado.

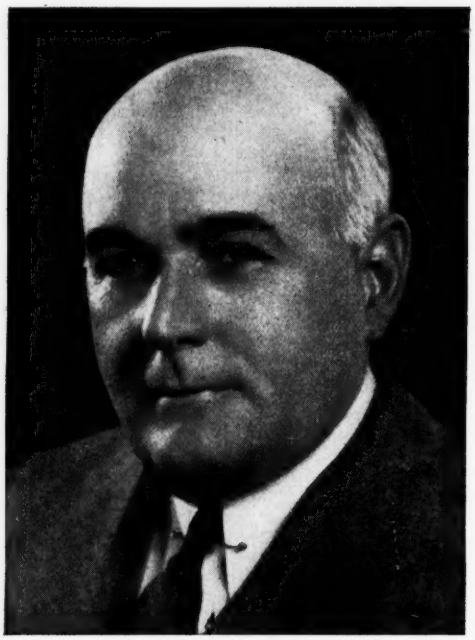
THURSDAY, JULY 16th

8:30 A.M. SUBJECT ON EAR, NOSE, AND THROAT (To be announced).
Thomas C. Galloway, M.D., Evanston, Illinois.

8:50 A.M. Discussion opened by Thomas E. Carmody, M.D., F.I.C.S., F.A.C.S., Denver, Colorado.

9:00 A.M. MANAGEMENT OF COMPLICATED GALLBLADDER DISEASES.
Clarke D. Brooks, M.D., F.I.C.S., F.A.C.S., Detroit, Michigan.

9:20 A.M. Discussion opened by James C. MacGregor, M.D., F.I.C.S., Great Falls, Montana, and Herbert A. Black, M.D., F.I.C.S., F.A.C.S., Pueblo, Colorado.



Thomas A. Shallow, M.D., F.I.C.S.,F.A.C.S.
President-Elect, U. S. Chapter

9:30 A.M. SURGICAL CONSIDERATION OF OBSTRUCTING LESIONS OF THE COMMON DUCT.
Verne C. Hunt, M.D., F.A.C.S., Los Angeles, California.

9:50 A.M. Discussion opened by John M. Foster, Jr., M.D., F.A.C.S., Denver, Colorado.

10:00 A.M. INTERMISSION to view exhibits.

11:00 A.M. SURGICAL APPROACH TO MENINGIOMAS IN REGION OF THE SPHENOID RIDGE CAUSING UNILATERAL EXOPHTHALMUS.
S. N. Berens, M.D., F.I.C.S., F.A.C.S., Seattle, Washington.

11:20 A.M. Discussion opened by J. Rudolph Jaeger, M.D., F.I.C.S., Denver, Colo.

11:30 A.M. REPAIR OF WAR INJURIES TO THE BLOOD VESSELS BY SUTURE.
Charles Goodman, M.D., F.A.C.S., New York City.

11:50 A.M. Discussion opened by George W. Bancroft, M.D., F.I.C.S., F.A.C.S., Colorado Springs, Colorado.

12:00 M. *Round-Table Luncheon*—Silver Glade, Cosmopolitan Hotel.
Dr. Max Thorek, Chicago, Illinois, Presiding.
Drs. Galloway, Brooks, Hunt, Berens, and Goodman participating.

2:00 P.M. THE PRESERVATION OF THE SPHINCTER ANI IN RADICAL OPERATION FOR CARCINOMA OF THE RECTUM.
A. A. Berg, M.D., F.I.C.S., New York City.

2:20 P.M. Discussion opened by George B. Kent, M.D., F.I.C.S., F.A.C.S., Denver, Colo.

2:30 P.M A NEW METHOD OF CERTAIN TYPES OF CANCER OF THE BLADDER.
Lowell S. Goin, M.D., Los Angeles, California.

2:50 P.M. Discussion opened by James S. Philpott, M.D., Denver, Colorado.

3:00 P.M. INTERMISSION to view exhibits.

4:00 P.M. THE RELATION OF GENERAL SURGERY TO EYE DISEASES.
William H. Ryder, M.D., F.I.C.S., New Haven, Connecticut.

4:20 P.M. Discussion opened by William M. Bane, M.D., Denver, Colorado.

4:30 P.M. AMBULATORY CASTLESS METHOD OF TREATING COMPOUND FRACTURES.
Roger Anderson, M.D., F. I. C. S., F.A.C.S., Seattle, Washington.

4:50 P.M. Discussion opened by Hamilton I. Barnard, M.D., F.I.C.S., F.A.C.S., Denver, Colorado, and Ervin A. Hinds, M.D., F.A.C.S., Denver, Colorado.

5:00 P.M. COLORED ILLUSTRATIONS OF THE GELLHORN-DICKINSON TECHNIQUE FOR VAGINAL HYSTERECTOMY UNDER LOCAL ANESTHESIA, WITH AN ANALYSIS OF 600 CASES.
Fred V. Emmert, M.D., F.I.C.S., F.A.C.S., St. Louis, Missouri.

5:20 P.M. Discussion opened by Dean W. Hodges, M.D., F.I.C.S., Denver, Colorado.

EVENING Convocation at Phipps Auditorium, Denver City Park.
B. I. Golden, M.D., F.I.C.S., F.A.C.S., Marshal.
ADDRESS
Desiderio Román, M.D., F.I.C.S., F.A.C.S., President.
ADDRESS
Thomas A. Shallow, M.D., F.I.C.S., F.A.C.S., President-elect.

FRIDAY, JULY 17th

8:30 A.M. UN-UNITED FRACTURES WITH OR WITHOUT LOSS OF BONE SUBSTANCE—Report of 1,147 cases.
Fred Albee, M.D., F.I.C.S., F.A.C.S., New York City.

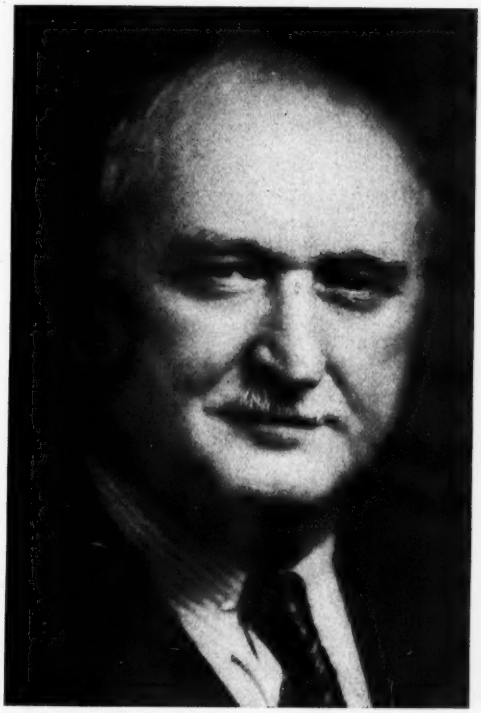
9:00 A.M. INTRAGASTRIC PHOTOGRAPHY.
Dayton H. O'Donnell. M.D., Detroit, Michigan.

9:20 A.M. Discussion opened by Frank McGlone, M.D., Denver, Colorado.

9:30 A.M. DRAINAGE INTO ALIMENTARY CANAL AS METHOD OF CHOICE IN OPERATIVE TREATMENT OF PANCREATIC CYSTS AND FISTULAE.
Rudolf Nissen, M.D., F.I.C.S., New York City.

9:50 A.M. Discussion opened by Duval J. Prey, M.D., F.A.C.S., Denver, Colorado.

10:00 A.M. INTERMISSION to view exhibits.



Fred H. Albee, M.D., F.A.C.S., F.I.C.S.
International President

11:00 A.M. THE HISTORY AND PRACTICAL ROLE OF DIAGNOSTIC SURGICAL PATHOLOGY.
Wm. Carpenter MacCarty, M.D., Rochester, Minnesota.

11:20 A.M. Discussion opened by William C. Black, M.D., Denver, Colorado.

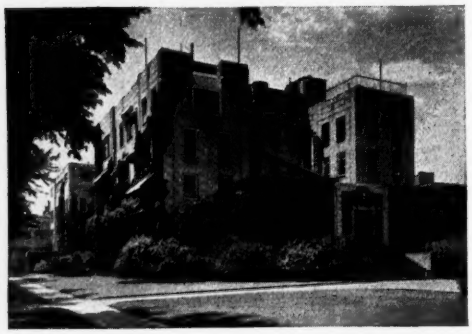
11:30 A.M. PSYCHOTHERAPY IN GENERAL MEDICINE AND SURGERY.
Tom B. Throckmorton, M.D., Des Moines, Iowa.

11:50 A.M. Discussion opened by Franklin G. Ebaugh, M.D., Denver, Colorado.

12:00 M. *Round-Table Luncheon*—Silver Glade, Cosmopolitan Hotel.
Dr. Dayton H. O'Donnell, Detroit, Michigan, Presiding.
Drs. Albee, Nissen, MacCarty, and Throckmorton participating.

2:00 P.M. SECTION OF LISSAUER'S TRACT, A CONTRIBUTION TO CHORDOTOMY FOR THE RELIEF OF PAIN.
Olan R. Hyndman, M.D., Iowa City, Iowa.

2:20 P.M. Discussion opened by L. E. Daniels, M.D., Denver, Colorado.



Section of Denver Children's Hospital

Glimpse of Denver's famed Civic Center

Univ. of Colo. School of Medicine and Hospitals

2:30 P.M. SURGERY OF PULMONARY TUBERCULOSIS WITH COLORED MOTION PICTURES.
Herbert Acuff, M. D., F. I. C. S., F.A.C.S., Knoxville, Tennessee.

2:50 P.M. Discussion opened by John B. Grow, M.D., Denver, Colorado.

3:00 P.M. INTERMISSION to view exhibits.

3:30 P.M. CERTAIN OBSERVATIONS ON RIGHT UPPER QUADRANT SURGERY.
Harry H. Everett, M.D., F.I.C.S., F.A.C.S., Lincoln, Nebraska.

3:50 P.M. Discussion opened by Olaf J. Hagen, M.D., F.I.C.S., F.A.C.S., Fargo, North Dakota.

4:00 P.M. A PRESENTATION OF SCIENTIFIC SOUND FILM: PHYSIOLOGICAL REACTIONS DURING OPERATIONS IN THE ABDOMINAL AND THORACIC CAVITIES (In Four Parts)

and

PHYSIOLOGICAL REACTIONS DURING OPERATIONS ON THE BRAIN. (In Five Parts)

Operation and Direction by Academician Nicholai N. Burdenko, Chief Surgeon of the Russian Armies.
Presented by Desiderio Román, M.D., F.I.C.S., F.A.C.S., Philadelphia, Penn.

EVENING President's Reception and Ball—Shirley-Savoy Hotel.

ADDRESS
Ralph L. Carr, Governor of the State of Colorado.

SATURDAY, JULY 18th

MORNING OPERATIVE CLINICS will be held in the following hospitals:
University of Colorado School of Medicine and Hospitals.
Fitzsimons General Hospital, U. S. Army.
Children's Hospital
Denver General Hospital
Mercy Hospital
National Jewish Hospital
Presbyterian Hospital
St. Anthony's Hospital
St. Joseph's Hospital
St. Luke's Hospital

AFTERNOON A tour of the Denver Mountain Parks with a Picnic Dinner and entertainment at 6:30 at Troutdale-in-the-Pines.

PANEL DISCUSSIONS
WEDNESDAY, JULY 15th

MORNING BROWN-PALACE HOTEL, Onyx Room

9:00 A.M. PEPTIC ULCER:
Thomas A. Shallow, M.D., Philadelphia, Pennsylvania.
Herbert A. Black, M.D., Pueblo, Colo.
W. W. Haggart, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D

9:00 A.M. TRANSURETHRAL VERSUS SUPRAPUBIC ON PROSTATIC OBSTRUCTION:
Elmer Hess, M.D., Erie, Pennsylvania.
Henry A. Buchtel, M.D., Denver, Colo.
T. Leon Howard, M.D., Denver, Colo.

10:00 A.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

11:00 A.M. VENTRAL AND INCISIONAL HERNIAS:
Deriderio Román, M.D., Philadelphia, Pennsylvania.
E. Vernon Mastin, St. Louis, Missouri.
Duval Prey, M.D., Denver, Colorado.

COSMOPOLITAN HOTEL, Room D

11:00 A.M. HOSPITAL AND SURGEON RELATIONSHIP:
T. R. Ponton, M.D., Editor, Hospital Management, Chicago, Illinois.
H. R. McGraw, M.D., Medical Director, Denver General Hospital, Denver, Colorado.
Mr. Walter G. Christie, Superintendent, Presbyterian Hospital, Denver, Colorado.

12:00 M. INTERMISSION for Luncheon

AFTERNOON BROWN-PALACE HOTEL, Onyx Room

2:00 P.M. INFECTION OF THE NECK:
Brien T. King, M.D., Seattle, Wash.
Thomas E. Carmody, M.D., Denver, Colorado.
M. O. Shivers, M.D., Colorado Springs, Colorado.

COSMOPOLITAN HOTEL, Room D

2:00 P.M. INTESTINAL OBSTRUCTION:
Clark D. Brooks, M.D., Detroit, Mich.
Nolie Mumey, M.D., Denver, Colorado.
William H. Mast, M.D., Gunnison, Colorado.

3:00 P.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

3:30 P.M. SURGERY OF HYPERTENSION:
S. N. Berens, M.D., Seattle, Wash.
Manuel A. Manzanilla, M.D., Mexico City, D.F.
Douglas Deeds, M.D., Denver, Colo.
William R. Lipscomb, M.D., Denver, Colorado.

COSMOPOLITAN HOTEL, Room D.

3:30 P.M. PROCTOLOGY:
A. J. Chisholm, M.D., Denver, Colo.
Harry W. LeFevre, Jr., M.D., Denver, Colorado.

BROWN-PALACE HOTEL, Onyx Room

4:30 P.M. CARCINOMA OF THE STOMACH:
Alfred A. Strauss, M.D., Chicago, Ill.
E. J. Meister, M.D., Denver, Colorado.
Wm. Carpenter MacCarty, M.D., Rochester, Minnesota.

COSMOPOLITAN HOTEL, Room D.

4:30 P.M. (BAD RISK) EXOPHTHALMIC GOITER:
Andre Crotti, M.D., Columbus, Ohio.
Arnold S. Jackson, M.D., Madison, Wisconsin.
George B. Kent, M.D., Denver, Colo.

THURSDAY, JULY 16th

MORNING BROWN-PALACE HOTEL, Onyx Room

9:00 A.M. CARCINOMA OF THE COLON:
A. A. Berg, M.D., New York City.
William W. Webster, M.D., Greeley, Colorado.
L. S. Faust, M.D., Denver, Colorado.

COSMOPOLITAN HOTEL, Room D.

9:00 A.M. EYE DISEASES:
William Ryder, M.D., New Haven, Connecticut.
George Stine, M.D., Colorado Springs, Colorado.
Guy H. Hopkins, M.D., Pueblo, Colo.
W. A. Ohmart, M.D., Denver, Colo.

10:00 A.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

11:00 A.M. FRACTURE OF THE LONG BONES:
Roger Anderson, M.D., Seattle, Wash.
J. E. A. Connell, M.D., Denver, Colo.
Harry C. Hughes, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

11:00 A.M. TREATMENT OF SHOCK:
Edwin C. Henry, M.D., Omaha, Nebr.
Fred V. Emmert, M.D., St. Louis, Mo.
E. R. Mugrage, M.D., Denver, Colo.

12:00 M. INTERMISSION for Luncheon

AFTERNOON BROWN-PALACE HOTEL, Onyx Room

2:00 P.M. INDUSTRIAL SURGERY:
Carl M. Peterson, M.D., Chicago, Ill.
George F. Netherton, M.D., Denver, Colorado.
Robert H. Fitzgerald, M.D., Leadville, Colorado
Freeman D. Fowler, M.D., Denver, Colorado.
Frank J. Evans, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

2:00 P.M. ACUTE APPENDICITIS AND ACUTE APPENDICITIS WITH PERFORATION:
Harry Everett, M.D., Lincoln, Nebr.
John M. Foster, Jr., M.D., Denver, Colorado.
George H. Gillen, M.D., Denver, Colo.
Myron W. Cooke, M.D., Longmont, Colorado.

3:00 P.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

3:30 P.M. VARICOSE VEINS:
Charles Goodman, M.D., New York City.
T. M. Rogers, M.D., Sterling, Colo.
A. W. Metcalf, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

3:30 P.M. OBSTETRICS:
E. L. Harvey, M.D., Denver, Colorado.
Homer R. Dietmeier, M.D., Longmont, Colorado.
J. U. Sickenberger, M.D., Grand Junction, Colorado.

BROWN-PALACE HOTEL, Onyx Room

4:30 P.M. GALLBLADDER DISEASE:
Verne C. Hunt, M.D., Los Angeles, California.
Max Thorek, M.D., Chicago, Illinois.
H. J. Freeland, M.D., Denver, Colo.
G. H. Curfman, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

4:30 P.M. EAR AND MASTOID DISEASE:
Thomas E. Carmody, M.D., Denver, Colorado.
George L. Pattee, M.D., Denver, Colo.
F. O. Kettlekamp, M.D., Colorado Springs, Colorado.

FRIDAY, JULY 17th

MORNING BROWN-PALACE HOTEL, Onyx Room

9:00 A.M. HEAD INJURIES:
Olan R. Hyndman, M.D., Iowa City, Iowa.
L. E. Daniels, M.D., Denver, Colorado.
J. Rudolph Jaeger, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

9:00 A.M. ABDOMINAL SURGERY IN CHILDREN:
Fred M. Douglass, M.D., Toledo, Ohio.
Ralph H. Verploeg, M.D., Denver, Colorado.

10:00 A.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

11:00 A.M. SURGERY OF THE CHEST:
Herbert Acuff, M.D., Knoxville, Tenn.
Colonel L. D. Hill, M.D., Fitzsimons General Hospital, Denver, Colorado.
Major John B. Grow, M.D., Fitzsimons General Hospital, Denver, Colorado.

COSMOPOLITAN HOTEL, Room D.

11:00 A.M. FRACTURE OF THE SPINE:
Fred Albee, M.D., New York City.
Robert G. Packard, M.D., Denver, Colorado.
Samuel P. Newman, M.D., Denver, Colorado.

12:00 M. INTERMISSION for Luncheon

AFTERNOON BROWN-PALACE HOTEL, Onyx Room

2:00 P.M. SURGERY OF THE PANCREAS:
Rudolf Nissen, M.D., New York City.
E. W. Barber, M.D., Denver, Colo.
M. C. Waddell, M.D., Denver, Colo.

COSMOPOLITAN HOTEL, Room D.

2:00 P.M. PARANASAL SINUSES:
Thomas C. Galloway, M.D., Evanston, Illinois.
F. R. Spencer, M.D., Boulder, Colo.
James P. Rigg, M.D., Grand Junction, Colorado.

3:00 P.M. INTERMISSION

BROWN-PALACE HOTEL, Onyx Room

3:30 P.M. POSTOPERATIVE PULMONARY COMPLICATIONS:
J. L. Campbell, M.D., Denver, Colo.
K. D. A. Allen, M.D., Denver, Colo.
J. D. Bartholomew, M.D., Boulder, Colorado.

COSMOPOLITAN HOTEL, Room D.

3:30 P.M. PELVIC TUMORS:
H. H. Ogilvie, M.D., San Antonio, Tex.
Clarence B. Ingraham, M.D., Denver, Colorado.
N. Paul Isbell, M.D., Denver, Colorado.

BROWN-PALACE HOTEL, Onyx Room

4:30 P.M. UN-UNITED FRACTURES:
Fred Albee, M.D., New York City.
Foster Matchett, M.D., Denver, Colo.
D. F. McKenna, M.D., Denver, Colo.

COSMOPOLITAN HOTEL:

4:30 P.M. HIP FRACTURES:
H. D. Corbusier, M.D., Plainfield, New Jersey.
Atha Thomas, M.D., Denver, Colorado.
Hamilton I. Barnard, M.D., Denver, Colorado.

SCIENTIFIC EXHIBITS

HEMATURIA
T. Leon Howard, M.D.
John M. Lipscomb, M.D.
Henry A. Buchtel, M.D.

INTERNAL DERANGEMENT OF THE KNEE JOINT
Robert G. Packard, M.D.
Hamilton I. Barnard, M.D.
I. E. Hendryson

PLASTIC AND RECONSTRUCTIVE SURGERY
Douglas Macomber, M.D.

DIAGNOSIS, PREVENTION, AND TREATMENT OF CARCINOMA OF THE CERVIX
F. B. Stephenson, M.D.
K. D. A. Allen, M.D.
John H. Jamison, M.D.

THE ANATOMY AND SURGICAL PATHOLOGY OF THE THYROID GLAND
George B. Kent, M.D.
Kenneth C. Sawyer, M.D.
Frank E. Roark, M.D.

PLASTIC CASES OF THE MOUTH AND FACE
Thomas E. Carmody, M.D.

DISEASE PROCESSES OF THE COLON—THEIR RECOGNITION AND MANAGEMENT
Robert K. Dixon, M.D.
L. S. Faust, M.D.

DEMONSTRATIONS OF BRAIN PATHOLOGY OF SURGICAL INTEREST
Franklin G. Ebaugh, M.D.
Karl Neuberger, M.D.

FILLING OF THE BILIARY DUCT SYSTEM WITH BARIUM MEAL FOLLOWING ANASTOMOSIS BETWEEN THE GALLBLADDER AND DUODENUM
N. B. Newcomer, M.D.
Elizabeth H. Newcomer, M.D.

A PICTORIAL STUDY OF HEART DISEASE
Edgar Durbin, M.D.

THE SURGICAL SIGNIFICANCE OF GALLBLADDER AND BILE DUCTS
Normal and abnormal relations of the biliary system with various pathological conditions of the gallbladder and different types of gall stones. Moulage demonstrations.
Nolie Mumey, M.D.

STUDIES ON NEUROMUSCULAR PHYSIOLOGY
Ora L. Huddleston, M.D.

GENITO-URINARY TUBERCULOSIS
Eli H. Miller, M.D.
Arthur Rest, M.D.

DIFFERENTIAL DIAGNOSIS OF COMMON SKIN LESIONS IN AND AROUND THE MOUTH FROM CARCINOMA OF THE LIP
G. M. Frumess, M.D.

THE HEART IN SURGICAL DIAGNOSIS
C. T. Burnett, M.D.

STABILIZING OPERATIONS ON THE FOOT
Harry C. Hughes, M.D.

ORTHODONTIA
K. E. Taylor, D.D.S.

CAST VITALLIUM PLATES FOR CLOSING DEFECTS IN THE SKULL
Charles G. Grover, D.D.S.

ROUTINE PHOTOGRAPHY AT FITZSIMONS GENERAL HOSPITAL
Colonel H. W. Mahon, M.D.

UNUSUAL PATHOLOGICAL SPECIMENS
Frank Maynor, M.D.

DEMONSTRATIONS OF NEW LABORATORY TECHNIQUE
Colorado Society of Medical Technologists

TECHNICAL EXHIBIT
Colorado Society of X-ray Technicians.

BLOCK ANESTHESIA OF THE MOUTH; DEMONSTRATIONS; ELECTRICALLY CONTOLLED MODEL
William Oberto, D.D.S.

EXHIBITIONS OF MEDICAL ILLUSTRATIONS
Waneeta Stevic

ENTERTAINMENT

Sightseeing trips through the city of Denver with its numerous interesting attractions as well as through the Denver Mountain Parks have been arranged for the doctors and their visiting ladies.

A Golf Tournament will be held at the famous Cherry Hills Country Golf Club, noted for its two recent prominent national golf tournaments: The Open Championship in 1938, and the 24th Championship of the Professional Golfers Association of America in 1941.

DENVER, THE CONVENTION CITY

When most of the rest of the world swelters in midsummer heat, Denver remains delightfully cool. The atmosphere is dry, sun-cleansed, invigorating. Showers are infrequent. Crisp, fresh breezes drift down from the snow-mantled peaks of the Continental Divide, 200 miles of which are visible from Denver. Nights are starry and cloudless. Even in midsummer you often sleep under blankets, and always you awake refreshed, with renewed zest for the day's diversions.

Denver has more than 300 days of sunshine each year, yet the perpetual mountain snows are so near that even in July and August the midday sun is never uncomfortably hot, nor the atmosphere oppressive. You'll find the days you spend in Denver comfortably warm, pleasantly vitalizing—the nights gratifyingly cool, restful, refreshing.

Denver, city of a thousand-and-one sights, where sightseeing is an adventure into loveliness. For background, the eye-filling grandeur of the majestic sweep of the Rockies' snowy main range. Emerald was never so green as the lawns of the two-score city parks, where you'll find no "Keep off the grass" signs.

Play while you look, if you please, as you enjoy the municipal golf courses, tennis courts, bathing beaches. If you choose, learn while you look, inspecting fascinating exhibits of Western fauna and minerals at the Museum of Natural History, or viewing relics of ancient cliff-swellers at the State Museum. Or, if you prefer, simply while the lazy hours away in the imposing Civic Center, with its unique and lovely open-air Greek Theatre.

Denver, after dark offers enchanting hours under a moon seldom obscured. Revel in the concert as your canoe drifts through the rainbow reflections of the gorgeous electric fountain. Or find fun and excitement in gay night clubs and restaurants. Denver's diversion keeps step with your holiday mood.

Fitzsimons U. S. General Hospital

In the Denver Mountain Playgrounds

Mummy Range, Rocky Mountain National Park, Colorado

DENVER'S 20,860 ACRES OF MOUNTAIN PARKS

Outstanding among Denver's countless out-of-door attractions that await you are its renowned Mountain Parks—unquestionably the world's most remarkable municipal-owned scenic area. Connected by more than 100 miles of broad, safeguarded, paved highway, are two-score separate mountain playground areas. They cover approximately 150 square miles of open parks, towering crags and cool, green woodlands.

Reached by automobile in an hour or less over splendid highways whose every bend discloses new and breath-taking scenic vistas, you'll find all manner of inviting summer hotels, resorts, cottages, and delightful camping and picnic grounds. No matter what type of holiday diversion you seek, you're certain to find it, easily accessible in the world-famous Denver Mountain Parks system. Virtually the year 'round you can enjoy a fascinating diversity of entertaining motor trips in this strange, marvelous and inspiring scenic area.

In a single day you may encircle the major portion of the park system, by bus or your own car. Twelve miles from Denver, at Golden, you enter the Mountain Parks, Ascending the serpentine Lariat Trail, you reach the summit of Lookout Mountain. From its crest you look out over Denver and hundreds of square miles of fertile, rolling plains. Here you may visit the grave of "Buffalo Bill" Cody. Close by in Pahaska Tepee Museum romantic names come to life as you gaze on the many relics of the last of the great scouts. A few miles to the west the road spirals to the top of Genesee Mountain, then continues through Bergen Park to Clear Creek and Idaho Springs, scene of the first discovery of gold in Colorado.

Turning south, you make the thrilling ascent to pine-fringed Echo Lake, at timberline, and thence over the world's highest mountain highway to the towering 14,260-foot summit of Mount Evans, site of the world's highest laboratory for the study of cosmic rays. Below you is spread out, map-like, a stupendous view of jagged peaks extending for more than 100 miles.

Returning, you descend by way of Troutdale and Evergreen Park, following beautiful, timbered Bear Creek canyon to Morrison and the foothills. Thence, you wind northward through Red Rocks Park, newest of the Denver Mountain Parks, where a gigantic out-of-doors theatre, seating 9,000, has just been completed. On the way back to Denver you drive through a valley where many dinosaur bones have been excavated, and where, from your car window, you may see the footprints of these prehistoric monsters preserved millions of years in the rock at the roadside.

This is but one of many enticing motor trips awaiting you in the Denver Mountain Parks system. Here you may spend carefree days, weeks or months, finding always something new to cherish among life's great moments. Here every view offers a new thrill to enrich vacation memories.

TRANSPORTATION

No wonder Denver's fame as a convention city has spread throughout the world! Where else, so conveniently located, can you find such a rare combination of convention inducements—cool, invigorating climate, limitless vacation attractions, unexcelled hotel accommodations, a spacious municipal auditorium, and such a genuine spirit of friendly hospitality? Denver lies not far from the geographical heart of the United States. You can reach it speedily and conveniently in your own car, or by rail, bus or plane. It is the center of a network of broad, smooth, paved highways. Railroads offering every comfort and luxury of modern travel converge at Denver. Clean, cool buses operate on convenient schedules. By air, Denver is but a matter of a few hours from your home. You'll find Denver a thoroughly modern city, experienced in catering to the needs and desires of great multitudes of visitors. Here you are almost certain to meet travelers from your own community. Expect, on your Denver visit, not only to find freedom from care along with the matchless climate and inspiring scenery, but to make new and lasting friendships. After the convention is finished, delegates and their families almost invariably take part in the gay summer activities in the glorious alpine setting of the Colorado mountains.

Colorado has more than 6,000 miles of trout streams and hundreds of lakes to which the nimrods flock during season.

Denver is the logical starting point for visits to the 12 national parks and 32 national monuments in this fascinating western land of wonders. Here convention delegates find rest and relaxation or gay, light-hearted entertainment. Travel adventures begin at home in happy anticipation. To insure a happy ending, delegates to Denver conventions plan to linger in the Colorado mountains for the vacation of their heart's desire.

Golf at the foot of the Rockies

DENVER HOTELS

For your comfort, pleasure and convenience, Denver offers you accommodations to meet your desires, at prices to fit your convention and vacation budget. Whether you travel modestly or seek the luxurious perfection of elegantly appointed hotels, you'll always find the same spirit of cordial western hospitality, no matter where you go.

For reservations and detailed information write:

Dr. Dean W. Hodges, Housing Committee
International College of Surgeons
502 Republic Building
Denver, Colorado.

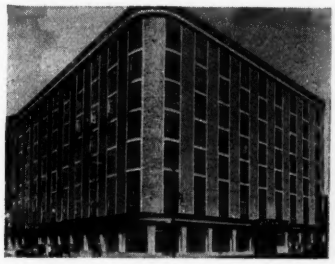
MOUNTAIN TRIPS AND RESORT ACCOMMODATIONS

This information can be obtained from writing the above Housing Committee.

HOTEL RATES

The Housing Committee recommends the following hotels—all prices quoted with bath.

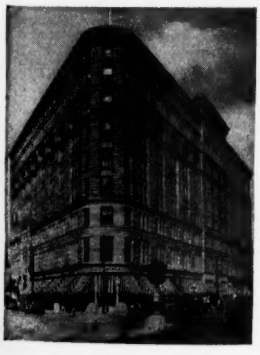
The Albany Hotel	
Single Rooms	$ 3.00 to $ 5.00
Twin Bedded Rooms	6.00 to 10.00
Suites	14.00 to 20.00
The Brown-Palace Hotel	
Single Rooms	$3.85, $4.40 and $5.50
Double Rooms with double bed	5.50, 6.60, and 7.70
Double Rooms with twin beds	6.60, 7.70, and 8.80
Living Room and Bedroom suites	$10.00 to $16.00
Colburn Hotel	
Double Rooms	$6.00
Cosmopolitan Hotel	
Single Rooms	$3.30, $ 3.85, $ 4.40, $ 5.50
Double Rooms	5.50, 6.60, 7.70, 8.80
Parlors en suite	8.00, 10.00, 12.00, 15.00
Olin Hotel	
Single Rooms	$ 3.50
Double Rooms	$7.00 to 8.00
Suites	12.00
Park Lane Hotel	
Double Rooms	$8.00
Suites	$12.00 to $15.00
Shirley-Savoy	
Single Rooms	$2.50 to $ 3.50
Double Rooms	3.50 to 4.50
Parlor and bedroom	8.00 to 10.00



Albany Hotel

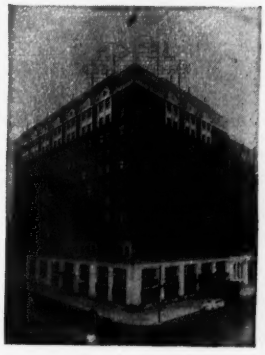
Olin Hotel

Hotel Shirley Savoy

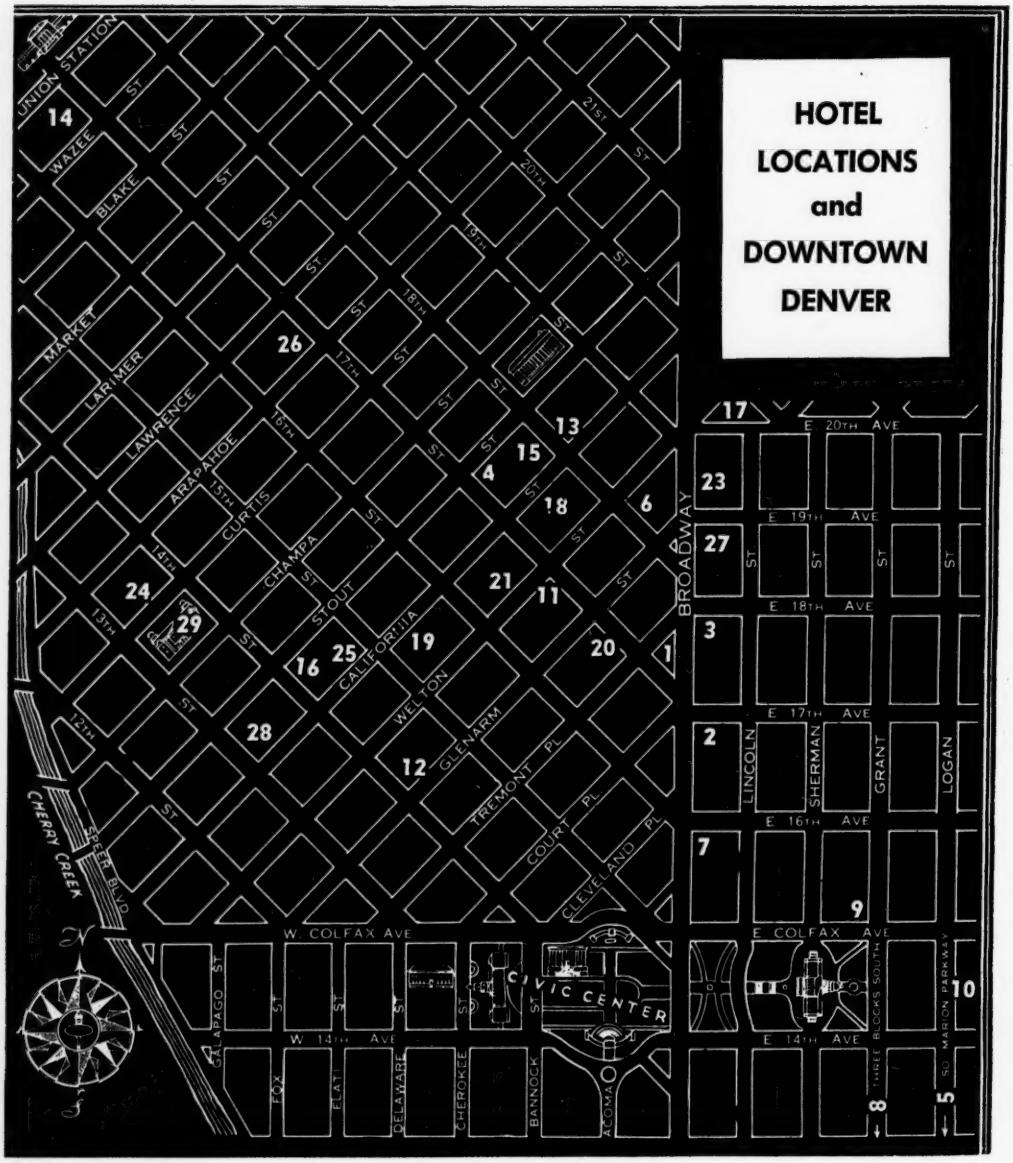


Brown Palace Hotel

Park Lane Hotel



Hotel Cosmopolitan



4. **Albany Hotel**
9. **Argonaut Hotel**
1. **Brown-Palace Hotel**
8. **Colburn Hotel**
3. **Cosmopolitan Hotel**
10. **Olin Hotel**
5. **Park Lane Hotel**
2. **Shirley-Savoy Hotel**
   Headquarters Hotel and Meeting Place

CORRESPONDENCE

PRINCIPLES OF HUMAN ANATOMY

To the Editor:

"This is in the nature of a rebuttal to your reviewer's rather querulous review of our book Principles of Human Anatomy, which review appeared in the Jr. Inter. Col. Surg., vol. 7, p. 287, 1940. The title of our book is justified on two counts: (1) The first half of the book is a guide to dissection and, as is well known, nothing so clearly exemplifies the principles of Anatomy as dissection. (2) The last half of the book is devoted to synopses which deal, often at length, with the principles we wish to stress. Since the reviewer did not mention the synopses at all, we infer that he failed to read them. For his perusal, perhaps even for his instruction, we recommend that he at least examine Synopsis VIII on the autonomic nervous system.

Your reviewer finds that our asking of questions without answering them works a hardship on the reader. So it does, if the reader cannot answer them. But our clear intention is to stimulate the student to seek for himself the answers from the cadaver, the large text, the atlas. This, we find, is much better teaching practice than the spoonfeeding method of answering our own questions.

He further observes that on our p. 37 the "hypothetical" case of incarcerated direct inguinal hernia is discussed, which makes him wonder why the classical case of incarcerated indirect inguinal hernia is not chosen. If he had only turned to p. 38 he would have found that both types of hernia are equally and briefly mentioned for the sole purpose of illustrating the importance of Hesselbach's triangle.

Also he objects to our p. 48, where we refer the student to various text figures of the cervical fascia. He correctly remarks that these figures are different. But should we lead the student to think that one text is completely right on the cervical fascia and the many texts that differ from it are completely wrong? Only on subjects which come within our own field of research can we make valid claims of choice between textbooks. Incidentally the textbooks differ on a host of things besides the cervical fascia.

C. F. De Garis, M.D., Ph.D.
Professor of Anatomy
School of Medicine
University of Oklahoma

The above letter was submitted to the reviewer whose reply follows:

"In answer to Dr. C. F. De Garis' letter, I wish to state:

(1) I believe that the title does not indicate the scope of the book. Since over 100 pages of the book are devoted to dissections, it, therefore, seems that a happier title stressing the dissection guide feature of the work could have been chosen.

(2) The reviewer is grateful to the author for agreeing in his letter that "asking questions without presenting the answers works a hardship on the reader." Having once been a student, and now teaching students, the reviewer feels that the clear, concise, explanatory method of teaching is still the method of choice in preference to the memorizing of questions and answers.

(3) The reviewer read page 38 and there found mention of "incarcerated indirect inguinal hernia." He still questions the wisdom of citing the rare example of *direct* incarcerated inguinal hernia. This may give a false clinical impression because *incarcerated direct hernia is, as is well known, one of the surgical rarities.*

(4) The author and reviewer again agree that many texts differ on certain anatomical points. It seems to me that one writing a book and attempting to clarify the existing confusion would hardly gain his objective by referring the student back to sources which are avowedly controversial and which at best tend to confuse.

One has only to write a book to appreciate the trials and tribulations that are entailed in such endeavor and the reviewer is sincerely sympathetic and appreciative of the time and effort which have gone into this volume. It is a good book and I wish to reiterate that it can be in all sincerity recommended. Nevertheless, constructive criticism does make better understanding."

P.

BOOK REVIEWS

Encephalitis, a clinical study; Josephine B. Neal, 563 pp. 22 figures. $6.75. Grune and Stratton, New York, 1942.

THIS book was written by Dr. Neal with the help of six well known contributors. Dr. Neal herself has written over half of the text. The volume deals with encephalitis and in one sense is the clinical report of eleven years of study of this disease by the Matheson Commission. It deals principally with so-called epidemic encephalitis, "Von Economo's encephalitis." However other important forms of encephalitis such as the St. Louis type, Japanese B, and encephalitis due to viruses of Eastern and Western equine encephalomyelitis, are thoroughly discussed and differentiated, and many other rarer and less important nonsuppurative types of encephalitis are briefly described. An important chapter deals with the neurologic complications following acute infections and vaccinations.

The section on the clinical course and treatment of epidemic encephalitis are based upon Dr. Neal's experience with records of 710 cases studied by the Matheson Commission. The clinical aspects and various manifestations of this protean disease of the brain are ably covered. Of especial importance is the survey of the results of treatment. This failed to show Rosenow's encephalitis anti-streptococcic serum and vaccine to be of any value. Vaccine "F", consisting of a formalized herpes virus, apparently was of value in all stages in halting the progress of the disease. However it should be noted that Rosenow's preparation was never used in the acute stages of the disease. Bella bulgara was found to be by far the most efficacious symptomatic treatment for chronic encephalitis. The author emphasizes well the value of prolonged convalescence following acute encephalitis in promoting complete and lasting recovery. To quote: "An inflamed brain rates rest as much as—or more than—an inflamed lung." The reviewer heartily agrees with her dictum of a period of convalescence of at least six months to a year in cases of acute encephalitis.

Various surgical procedures for the relief of tremor, torticollis, athetosis, and blepharospasm are discussed by Putnam, who is himself one of the pioneers in this field. Rosner and Bender discuss the psychiatric disturbances of encephalitis and particularly the post-encephalitic behavior disorders so frequently seen in children.

The final section by Stevenson on pathology covers not only epidemic encephalitis but all forms of nonpurulent encephalitis and a number of encephalopathies as well. This section will be of interest to every pathologist.

There is considerable repetition and overlapping of subject matter. The author recognizes this in her introduction. A certain amount of this is unavoidable in a book written by several contributors —however, there seems to be more than necessary in this volume. There is a marked paucity of illustrations except in the section on pathology. Admittedly the subject does not lend itself readily to illustrations—yet surely some of the patients so well described must have had photographs worth reproducing.

No neurologist should fail to read this book; psychiatrists, pediatricians, internists, public health officers, and many others will find it well worth their study.

H. C. Voris

Eagleton's Index and Abstracts of Literature on Progress in Intracranial Lesions Related to Aural and Nasal Conditions, W. P. Eagleton. Newark, N. J., 1941.

EAGLETON'S INDEX is an assembly of all of the articles and of the thoughts or facts emphasized by the author in successive abstracts from 1925 to 1940 inclusive, containing advances in the knowledge of intracranial states in relation to normal or diseased ear, nose and throat conditions. It was published for gratuitous distribution to American and British otologists in the interest of Anglo-American unity, and to commemorate the enactment of the Lend and Lease Law—"a new Magna Carta" of democracy's international cooperation, making accessible to any sincere worker a compilation of the recent literature on the borderline subjects pertaining to otology or rhinology, and neurology or neuro-surgery. This is the first compendium of subjects and evaluation of facts presented in their entirety up to the present time.

The index contains references classified under headings according to the chief thoughts as discussed by the author, as well as a complete author index.

The appendix contains reprints of the author's abstracts of intracranial lesions related to aural and nasal conditions referred to in the index, as reprinted from the Archives of Otolaryngology.

This work indicates an extensive survey and compilation of the literature by one who has engaged his efforts in this particular field for many years. It is regrettable that the edition has been limited to one thousand copies, since its value is inestimable.

No other survey serves in such a unique manner as an introduction in otology and rhinology. The subject matter of these abstracts includes many of the commonly encountered problems of otology and rhinology and the specialties.

This volume makes available for students, teachers, general practitioners, internists and surgeons information about progress in intracranial lesions related to aural and nasal conditions which will be of great aid in sound diagnosis and treatment.

M. T.

The History and Evolution of Surgical Instruments, C. J. S. Thompson. Foreword by Chauncey D. Leake. 113 pp., 115 fig. $8.50. Schuman's: New York City, 1942.

THIS book is well written in an interesting, easy-to-read style. It is divided into twelve chapters, each of which covers one type of generally used instrument. The text describes briefly the manner in which some of these instruments were used and by whom, thus giving an insight into the past of our profession and evolution of some of our present-day instruments.

The illustrations are photographs and line drawings of museum specimens which have been in the collections of the Royal College of Surgeons of London.

As a whole, the book could be considered a history of the development of twelve commonly used instruments of the present day surgeon.

H. E. Turner

The Treatment of Burns, Henry N. Harkins. XVI, 457 p., 120 fig. $6.50. Charles C. Thomas: Springfield, Ill., 1942.

IN PART I, **The Burn and Its Effects,** after giving an excellent summary of the history of burns, the author discusses the etiology, symptomatology, prognosis and medicolegal aspects. Chapter 2 consists of a lucid discussion of the pathology of burns well illustrated by photomicrographs. There are worthwhile chapters on chemical changes, blood concentration following burns, and shock. The physiological factors underlying the different shock theories (such as pathological physiology of the adrenals, the importance of fluid loss, and the influence of toxins) are discussed. Bacteriological findings in burns, and their importance in prognosis and therapy, early complications (such as sepsis, erysipelas, tetanus, and Curling's ulcer), late complications (such as keloid, contractures, and carcinoma) are well described. Part II, **Treatment,** covers exhaustively the whole field of local, as well as early and late plastic treatment. A valuable section of the book is Part III, in which the author gives careful consideration to the treatment of special kinds of burns, such as electrical and radiation burns, chemical burns, and burns caused by war gases and freezing. Part IV summarizes, in outline form, the general and specific treatments of burns step by step. The bibliography is thorough (1320 entries). There are also very complete author and subject indexes. The reading of this book should be considered a "must" by every surgeon who expects to treat patients suffering from any type of burn.

Horace E. Turner

Surgical Clinics of North America, Volume 22, Number 2, pp. 317-647. 69 Fig. April, 1942. W. B. Saunders Co., Philadelphia.

SINCE war efforts are so concerned with wounds, the combination of articles in this number is particularly happy, for it brings together (under the editorship of Dr. Frank L. Meleney material germane to the questions now at issue. Dr. Meleney contributes an article to Surgical Bacteriology, Dr. Carl W. Walter to Sterilization, Dr. Deryl Hart to Minimizing the Contamination of Operative Wounds. Dr. Alfred B. Longacre writes on Accidental Wound Infections, Dr. Harold D. Harvey on Infections of the Skin and Subcutaneous Tissue, Dr. Roy D. McClure on Infections of the Chest, Dr. William A. Altemeier on Surgical Infections of the Peritoneum, Dr. Michael L. Mason on Infections of the Hand, Drs. Meleney and John S. Lockwood on the Chemotherapy of Surgical Infections, and Dr. Champ Lyons on Immunological Aspects of Surgical Infections. Each of these articles is well written and contains up-to-date instructive and practical material. The volume concludes with some other important material which is not related to the principal theme. Of these articles, Dr. Arthur Krida's paper on congenital dislocation of the hip is excellent. The interesting contribution by Dr. John Russell Carty on the Use of X-Radiation as an Analgesic Agent is of much practical and timely value and the much discussed Scalenus Anticus Syndrome is admirably analyzed by Dr. K. G. Hansson. The conclusions here are illuminating. Dr. Henry L. Jaffe's article on Primary and Secondary (Renal) Hyperparathyroidism will prove of much interest. A cumulative index completes the volume. All in all, this is an excellent and timely contribution to contemporary surgical literature and can be highly recommended.

T.

Cancer of the Face and Mouth. Diagnosis, Treatment, Surgical Repair, Vilray P. Blair, Sherwood Moore, and Louis T. Byars. 599 p. 64 pl., 260 fig. $10. C. V. Mosby Co., St. Louis, 1941.

THIS is an excellent work on the subject, comprising 30 chapters. It evaluates from every point of view the therapeutics of carcinoma and the various factors governing same. This reviewer heartily agrees with the statement of Dr. J. M. T. Finney who in his introduction states: "The true value of a book is largely determined by the extent of the author's knowledge of the subject and experience in the early recognition and proper treatment of the problems under consideration, as well as the ability to present the subject matter in attractive and serviceable form." It is well known that views and opinions differ on the subjects under discussion, but the author's mature experience and the authoritative evaluation of the questions presented are truly worthwhile. It is refreshing to note that in the main the authors have substituted the term "node" for "gland." This is as it should be. The work is profusely illustrated. The photography, in monochrome, is exceptionally well executed. The chapter on carcinoma of the tongue, floor of the mouth, and pharynx is very expertly presented. The case illustrations bespeak the immense amount of material at the authors' command. All in all, this is a worthwhile contribution to the surgery of malignancy. The technic is thoroughly described. This description is augmented by pen drawings which, while very exact, are just what they are intended to be: sketches. This is a good book, worth studying.

M.

Oral Surgery. Sterling V. Mead, D.D.S., M.S. Second edition. 1315 p. 553 illus., 7 col. pl. 63s. Henry Kimpton, 1940.

THIS large volume comprises 47 chapters and discusses oral disease from the point of view of surgery. Oral bacteriology, surgical technic, the sterile field, anatomic relations, etc., are discussed, and methods of extracting teeth, treating fractures of the jaws, treating infections involving the mouth and neck, are outlined in detail. Quotations from many original sources are included in the text. Each chapter is followed by an extended

bibliography. Those engaged in oral surgery will find this volume useful.

T.

Technic of Gastric Operations. Rodney Maingot, F.R.C.S. (Eng. xii, 240 p. 55 illus. 15s. Oxford University Press, London, 1941.

THIS splendid monograph by a well known author will be welcomed not only by surgeons interested in abdominal surgery in general, but by those specializing in gastrointestinal diseases as well. The whole field of operative technic in gastric surgery is concisely, yet adequately described. Pre- and post-operative treatment of these cases is duly stressed, and treatment of possible resulting complications is discussed. The author regards gastric ulcer as a precursor of malignant disease more often than statistics would seem to indicate. At the same time, evidence of healing by radiography, biochemical tests, and gastroscopy should be irrefutable before surgical treatment is finally ruled out, Maingot points out. The various operative technics are outlined. The importance of each surgeon's possessing a thorough knowledge of his own particular technic in order to achieve the most successful results is stressed. This is a very readable volume, beautifully illustrated, and will be of unquestioned value to the student, general surgeon, specialist, and others interested in surgical progress.

M.T.

Métodos Modernos de Amputação. Edmundo Vasconcelos (In collaboration with Edgard Pinto de Souza and José Gonçalves Filho.) 253 p. 258 fig. Companhia Editora Nacional, São Paulo, 1942.

THIS volume is timely and instructive. It will prove of great usefulness, not only to those who read Portuguese, but also to others, because the detailed descriptions of the technics of the usual amputations are graphically illustrated by exceptionally fine pen drawings. These plates, while not in color, are executed with such admirable clarity that every surgeon who performs, or who expects to perform, amputations will reap a great deal of benefit from a perusal of this work. The volume comprises six chapters: the first deals with general methods, the second with general principles of amputations, the third with the indications for amputations, the fourth embraces very comprehensively the technic of amputation and disarticulation of the upper extremity; this is followed by a chapter dealing similarly with the lower extremity. The final (seventh) chapter describes prosthesis in a complete and lucid manner. The bibliography is exhaustive, containing 498 references garnered from the literature of the past as well as from contemporary writings. This work can unreservedly be recommended to students and surgeons.

M. T.

A Short Practice of Surgery. Hamilton Bailey, F.R.C.S. (Eng.) and R. J. McNeill Love, M.S., F.R.C.S. (Eng.), fifth edition viii, 1016p. 880 illus., 116 col. 30s. H. K. Lewis & Co. Ltd., London, 1941.

THE fifth edition of this splendid work will be welcomed by general surgeons and specialists, as well as by students and teachers of surgery. The volume is profusely illustrated, and the colored drawings are of outstanding quality. The fundamentals of bacteriology and the specific infectious diseases are reviewed. A discussion of the various surgical problems in each type of regional disorder follows. The principles of operations are outlined. There are descriptions of the clinical diagnostic and pathologic anatomic features. The concluding section on orthopedic surgery is exceptionally excellent. The readability of this textbook, occasioned by the succinctness and general attractiveness of the authors' style, will make it popular with all who wish to have on their shelves a general volume on clinical surgery. The authoritative information embodied in this volume and the methods of approach are exemplary.

T.

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